Chapter 8
Motor Vehicles

CITY OF TIGARD
OREGON

This chapter summarizes needs for the motor vehicle system for both existing and future conditions in the City of Tigard. This chapter also outlines the criteria to be used in evaluating needs, provides a number of strategies and recommends plans for motor vehicles (automobiles, trucks, buses and other vehicles). The needs, criteria and strategies were identified in working with the City's Task Force (which consisted primarily of the Tigard Planning Commission). This group explored automobile and truck needs in the City of Tigard and provided input about how they would like to see the transportation system in their city develop. The Motor Vehicle modal plan is intended to be consistent with other jurisdictional plans including Metro's *Draft Regional Transportation Plan (RTP),* Washington County's Transportation Plan and ODOT's *Oregon Highway Plan* (OHP).

The motor vehicle element of the TSP involves several elements as shown in Figure 8-1. This chapter is separated into the following ten sections:

- Criteria
- Functional Classification (including summary of cross sections and local street connectivity)
- Circulation and Capacity Needs
- Safety
- Access Management
- Maintenance
- Neighborhood Traffic Management
- Parking
- Transportation System Management/Intelligent Transportation Systems
- Truck Routes

CRITERIA

Tigard's TSP Task Force created a set of goals and policies to guide transportation system development in Tigard (see Chapter 2). Many of these goals and policies pertain specifically to motor vehicles. These goals and policies represent the criteria that all motor vehicle improvements or changes in Tigard should be measured against to determine if they conform to the intended direction of the City.

Goal 1 Livability

Policy 1 Maintain the livability of Tigard through proper location and design of transportation facilities.

Policy 3 Address issues of excessive speeding and through traffic on local residential streets through a neighborhood traffic program. The program should address corrective measures for existing problems and assure that development incorporates traffic calming.

CITY OF TIGARD
Transportation System Plan

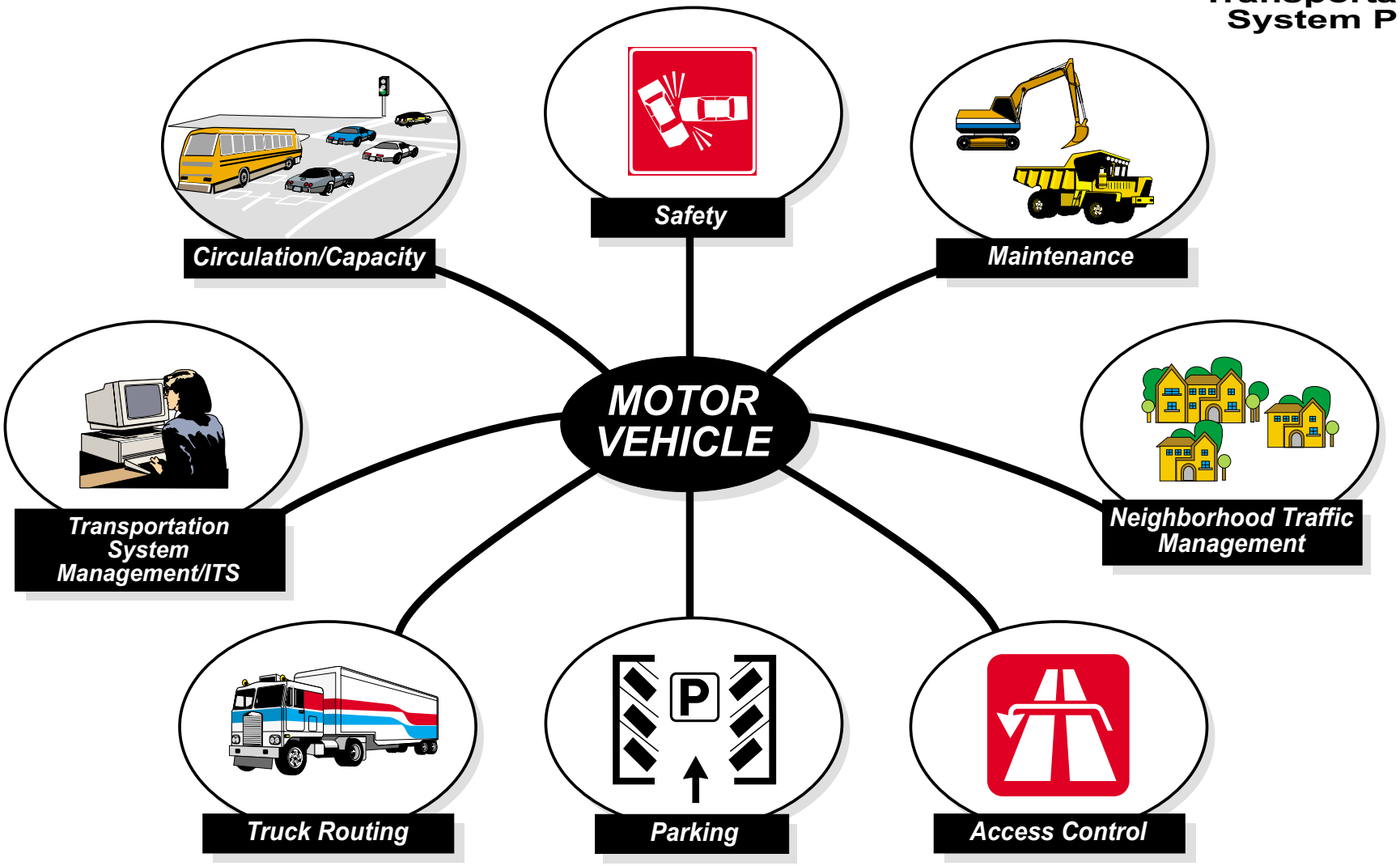


Figure 8-1
VEHICULAR ELEMENTS OF THE STREET PLAN

Goal 2 Balanced Transportation System

Policy 1 Develop and implement public street standards that recognize the multi-purpose nature of the street right-of-way for utility, pedestrian, bicycle, transit, truck and auto use.

Policy 6 Local streets shall be designed to encourage a reduction in trip length by providing connectivity and limiting out-of-direction travel. Provide connectivity to activity centers and destinations with a priority for bicycle and pedestrian connections

Policy 7 Tigard will participate in vehicle trip reduction strategies developed regionally targeted to achieve non-single occupant vehicle levels outlined in Table 1.3 of the Regional Transportation Plan.

Goal 3 Safety

Policy 1 Design of streets should relate to their intended use.

Policy 2 Street maintenance shall be a priority to improve safety in Tigard.

Policy 5 Access management standards for arterial and collector streets shall be developed to improve safety in Tigard.

Policy 6 Establish a City monitoring system that regularly evaluates, prioritizes and mitigates high accident locations within the City.

Goal 4 Performance Measures

Policy 1 A minimum intersection level of service standard shall be set for the City of Tigard. All public facilities shall be designed to meet this standard.

Policy 3 Work with Washington County, Metro, and ODOT to develop, operate and maintain intelligent transportation systems including coordination of traffic signals.

Goal 5 Accessibility

Policy 2 Develop neighborhood and local connections to provide adequate circulation in and out of the neighborhoods.

Policy 3 Work to develop an efficient arterial grid system that provides access within the City and serves through City traffic.

Goal 6 Goods Movement

Policy 1 Design arterial routes, highway access and adjacent land uses in ways that facilitate the efficient movement of goods and services.

FUNCTIONAL CLASSIFICATION

Roadways have two functions, to provide mobility and to provide access. From a design perspective, these functions can be incompatible since high or continuous speeds are desirable for mobility, while low speeds are more desirable for land access. Arterials emphasize a high level of mobility for through movement; local facilities emphasize the land access function; and collectors offer a balance of both functions (Figure 8-2).

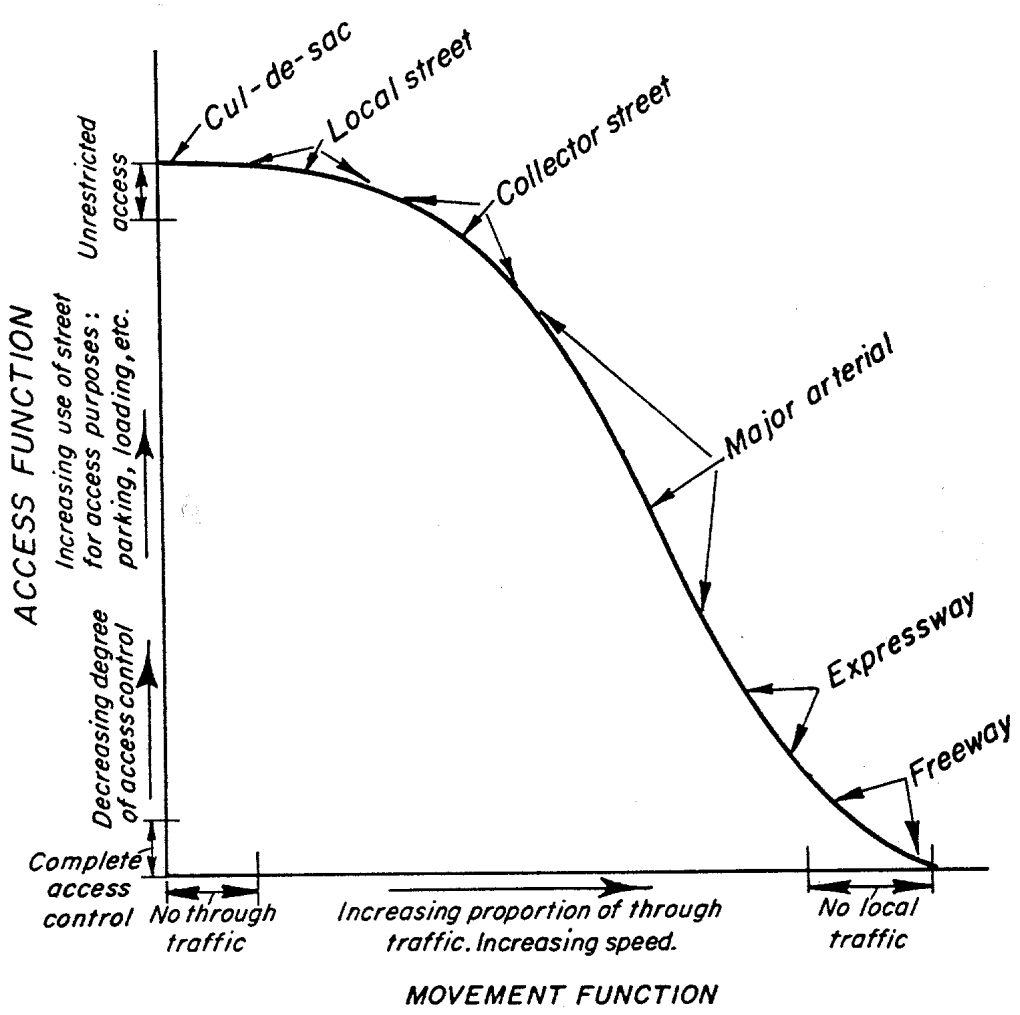
Functional classification has commonly been mistaken as a determinate for traffic volume, road size, urban design, land use and various other features which collectively are the elements of a roadway, but do not represent function. For example, the volume of traffic on a roadway is directly related to land uses and because a roadway carries a lot or a little traffic does not necessarily determine its function. The traffic volume, design (including access standards) and size of the roadway are outcomes of function, but do not define function.

Function can be best defined by connectivity. Without connectivity, neither mobility nor access can be served. Roadways that provide the greatest reach of connectivity are the highest level facilities. **Arterials** can be defined by regional level connectivity. These routes go beyond the city limits in providing connectivity and can be defined into two groups: principal arterials (typically state routes) and arterials. The efficient movement of persons, goods and services depends on an interconnected arterial system.

Collectors can be defined by citywide or district wide connectivity. These routes span large areas of the city but typically do not extend significantly into adjacent jurisdictions. They are important to city circulation. The past textbooks on functional classification generally defined all other routes as **local streets**, providing the highest level of access to adjoining land uses. These routes do not provide through connection at any significant regional, city-wide or district level.

Based upon connectivity there is a fourth level of functional classification - **neighborhood route**. In many past plans, agencies defined a minor collector or a neighborhood collector; however, use of the term collector is not appropriate. Collectors provide citywide or large district connectivity and circulation. There is a function between a collector and a local street that is unique due to its level of connectivity. Local streets can be cul-de-sacs or short streets that do not connect to anything.[1] Other routes people use to get in and around their neighborhood. They have connections within the neighborhood and between neighborhoods. These routes have neighborhood connectivity, but do not serve as citywide streets. They have been the most sensitive routes to through, speeding traffic due to their residential frontages. Because they do provide some level of connectivity, they can commonly be used as cut-through routes in lieu of congested or less direct arterial or collector streets that are not performing adequately. Cut-through traffic has the highest propensity to speed, creating negative impacts on these neighborhood routes. By designating these routes, a more systematic citywide program of neighborhood traffic management can be undertaken to protect these sensitive routes.

[1] Or in the case of neo-traditional grid systems, extensive redundancy in facilities results in local status to streets that have greater than local connectivity.



Source: University of California, 'Fundamentals of Traffic Engineering' Wolfgang S. Homburger and James H. Kell

Figure 8-2
STREET FUNCTION RELATIONSHIP

In the past, traffic volume and the size of a roadway have been directly linked to functional classification. More recently, urban design and land use designations have also been tied to functional classification. Discussions of neo-traditional street grids that eliminate the need for functional classification creates another commentary on this issue. All of these approaches to functional classification tend to be confusing and ever changing, complicating an essential transportation planning exercise. The planning effort to identify connectivity of routes in Tigard is essential to preserve and protect future mobility and access, by all modes of travel. In Tigard, it is not possible to have a citywide neo-traditional layout. Past land use decisions, topography and environmental features preclude this[2]. Without defining the varying levels of connectivity now in the TSP, the future impact of the adopted Comprehensive Plan land uses will result in a degraded ability to move goods and people (existing and future) in Tigard. The outcome would be intolerable delays and much greater costs to address solutions later rather than sooner.

By planning an effective functional classification of Tigard streets[3], the City can manage public facilities pragmatically and cost effectively. These classifications do not mean that because a route is an arterial it is large and has lots of traffic. Nor do the definitions dictate that a local street should only be small with little traffic. Identification of connectivity does not dictate land use or demand for facilities. The demand for streets is directly related to the land use. The highest level connected streets have the greatest potential for higher traffic volumes, but do not necessarily have to have high volumes as an outcome, depending upon land uses in the area. Typically, a significant reason for high traffic volumes on surface streets at any point can be related to the level of land use intensity within a mile or two. Many arterials with the highest level of connectivity have only 35 to 65 percent "through traffic". Without the connectivity provided by arterials and collectors, the impact of traffic intruding into neighborhoods and local streets goes up substantially.

If land use is a primary determinate of traffic volumes on streets, then how is it established? In Oregon, land use planning laws require the designation of land uses in the Comprehensive Plan. Tigard's Comprehensive Plan land uses have been designated for over two decades. These land use designations are very important not only to the City for planning purposes, but to the people that own land in Tigard. The adopted land uses in Tigard have been used in this study, working with the Metro regional forecasts for growth in the region for the next 20 years. A regional effort, coordinated by Metro and local agencies, has been undertaken to allocate the determined overall land use in the most beneficial manner for transportation. Without this allocation, greater transportation impacts would occur (wider and more roads than identified in this plan). As discussed in Chapter 10, if the outcome of this TSP is either too many streets or solutions that are viewed to be too expensive, it is possible to reconsider the core assumptions regarding Tigard's livability - its adopted land uses or its service standards related to congestion. The charge of this TSP (as mandated by State law) is to develop a set of multi-modal transportation improvements to support the Comprehensive Plan land uses. Key to this planning task is the functional classification of streets.

[2] While subdivisions or areas of neo-traditional development exist and are possible (even desirable), on the whole, the concept cannot be generically applied citywide in lieu of functional classification.

[3] Including definition of which routes connect through Tigard, within Tigard and which routes serve neighborhoods and the local level in the city.

Functional Classification Definitions

The proposed functional classification of streets in Tigard is represented by Figure 8-3. Any street not designated as either an arterial, collector or neighborhood route is considered a local street.

Principal Arterials are typically freeways and state highways that provide the highest level of regional connectivity. These routes connect over the longest distance (many miles long) and are less frequent than other arterials or collectors. These highways generally span several jurisdictions and many times have statewide importance (as defined in the ODOT Level of Importance categorization).[4] In Tigard, I-5 is designated an Interstate Highway and two routes (ORE 217 and ORE 99W) are designated Statewide Highways. All three of these routes are part of the National Highway System. While State Highways make up only 10 percent of Oregon's road mileage, they handle over 60 percent of the daily traffic[5].

Arterial streets serve to interconnect and support the principal arterial highway system. These streets link major commercial, residential, industrial and institutional areas. Arterial streets are typically spaced about one mile apart to assure accessibility and reduce the incidence of traffic using collectors or local streets for through traffic in lieu of a well placed arterial street. Access control is the key feature of an arterial route. Arterials are typically multiple miles in length. Many of these routes connect to cities surrounding Tigard and commonly provide access to freeways via interchanges.

Collector streets provide both access and circulation within and between residential and commercial/industrial areas. Collectors differ from arterials in that they provide more of a citywide circulation function, do not require as extensive control of access (compared to arterials) and penetrate residential neighborhoods, distributing trips from the neighborhood and local street system. Collectors are greater than 0.5 to 1.0 miles in length.

Neighborhood routes are usually long relative to local streets and provide connectivity to collectors or arterials. Because neighborhood routes have greater connectivity, they generally have more traffic than local streets and are used by residents in the area to get into and out of the neighborhood, but do not serve citywide/large area circulation. They are typically about a quarter to a half mile in total length. Traffic from cul-de-sacs and other local streets may drain onto neighborhood routes to gain access to collectors or arterials. Because traffic needs are greater than a local street, certain measures should be considered to retain the neighborhood character and livability of these routes. Neighborhood traffic management measures are often appropriate (including devices such as speed humps, traffic circles and other devices - refer to later section in this chapter). However, it should **not** be construed that neighborhood routes automatically get speed humps or any other measures. While these routes have special needs, neighborhood traffic management is only one means of retaining neighborhood character and vitality.

Local Streets have the sole function of providing access to immediate adjacent land. Service to "through traffic movement" on local streets is deliberately discouraged by design.

[4] 1999 Oregon Highway Plan, ODOT, March 1999.

[5] 1999 Oregon Highway Plan, ODOT, March 1999, page 13.

DKS *Associates*

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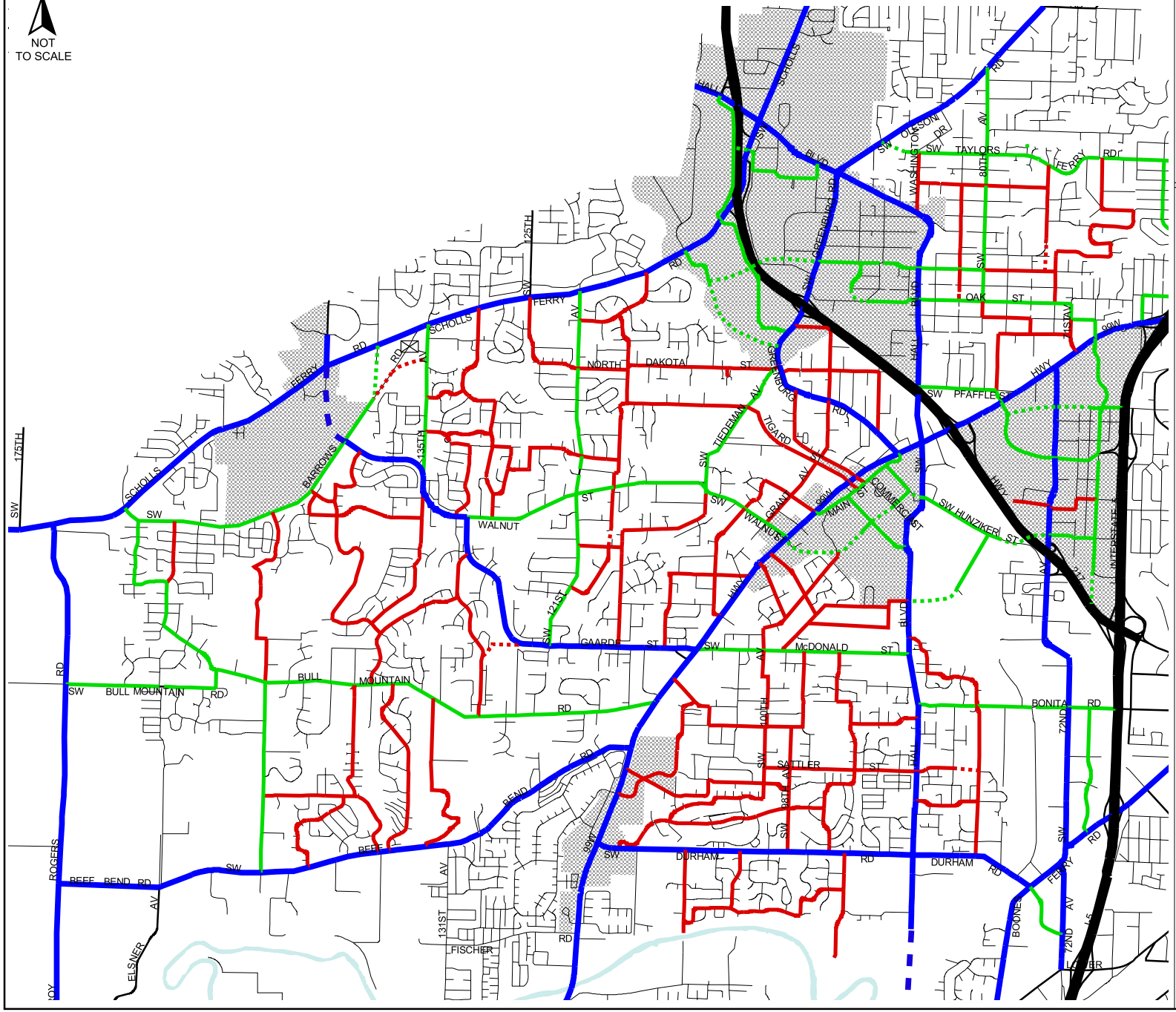

CITY OF TIGARD
OREGON

Transportation Systems Plan

Legend

- Road Closure

Functional Classification

- Proposed Freeway
- Proposed Arterial
- Proposed Collector
- Proposed Neighborhood Route
- Planned Arterial
- Planned Collector
- Planned Neighborhood Route
- Regional Center, Town Center, or Sub Area

*-Transportation facilities in the Tigard Triangle and Washington Square planning areas have specific design regulations and classifications that may slightly differ from those in the TSP for consistency purposes. In these overlay areas, there are specific planning overlay documents for transportation design regulations.

Note: The exact alignment of dashed lines to address physical, access control, right-of-way and environmental constraints in alignment developement.

Figure 8-3
Proposed Functional Classification System

Functional Classification Changes

The proposed functional classification differs from the existing approved functional classification. Neighborhood routes were not defined in the existing functional classification. The proposed functional classification was developed following detailed review of Tigard's, Washington County's and Metro's current functional classification maps. Table 8-1 summarizes the major differences between the proposed functional classification and the existing designations for streets in Tigard. This table also outlines the streets which were previously designated collectors that are now identified as neighborhood routes.

Criteria for Determining Changes to Functional Classification

The criteria used to assess functional classification have two components: the extent of connectivity (as defined above) and the frequency of the facility type. Maps can be used to determine regional, city/district and neighborhood connections. The frequency or need for facilities of certain classifications is not routine or easy to package into a single criterion. While planning textbooks call for arterial spacing of a mile, collector spacing of a quarter to a half mile, and neighborhood connections at an eighth to a sixteenth of a mile, this does not form the only basis for defining functional classification. Changes in land use, environmental issues or barriers, topographic constraints, and demand for facilities can change the frequency for routes of certain functional classifications. While spacing standards can be a guide, they must consider other features and potential long term uses in the area (some areas would not experience significant changes in demand, where others will). Linkages to regional centers and town centers are another consideration for addressing frequency of routes of a certain functional classification. Connectivity to these areas is important, whereas linkages that do not connect any of these centers could be classified as lower levels in the functional classification.

Table 8-1
Proposed Changes to Existing Roadway Classification

	Roadway Classification According to Jurisdiction			
Roadway	**Tigard**	**Wash County**	**Metro**	**Proposed TSP**
Greenburg Road	Major Collector	Minor Arterial/ Major Collector	Major Arterial	Arterial
72nd Avenue	Major Collector	Study Area	Minor Arterial	Arterial
Durham (W. of Hall)	Major Collector	Study Area	Minor Arterial	Arterial
Murray (Scholls Ferry to Barrows)	Major Collector	Proposed Collector	Proposed Collector of Regional Significance	Arterial
Walnut (Barrows to Gaarde)	Major Collector	Proposed Collector	Collector of Regional Significance	Arterial
Gaarde Street	Major Collector	Proposed Collector/ Major Collector	Collector of Regional Significance	Arterial
Beef Bend Road	Major Collector	Major Collector	Collector of Regional Significance	Arterial
Barrows Road	Arterial	Major Collector	Not Classified	Collector
Sequoia Parkway	Not Classified	Not Classified	Not Classified	Collector
Oak St (e of Lincoln)	Not Classified	Not Classified	Not Classified	Collector
Oak St (w of Lincoln)	Minor Collector	Not Classified	Not Classified	Local

Table 8-1 (cont.)

Tech Center Drive	Minor Collector	Not Classified	Not Classified	Local
97th/98th Avenue	Major Collector	Major Collector	Not Classified	Neighborhood

Routes that Change from Minor Collector to Neighborhood Route

135th (s/o Gaarde)	Sunrise Lane	Watkins Avenue	Summerfield Drive
133rd Avenue	Benchview Terrace	Grant Avenue	Sattler Street
130th Avenue	Peachtree Drive	Park Street	Ross Street
128th Avenue	Morning Hill Drive	Johnson Street	Alderbrook Drive
115th Avenue	Falcon Rise Drive	Commercial Street	Pinebrook Street
109th Avenue	Winter Lake Drive	Shady Lane	
98th Avenue	North Dakota St.	Washington Drive	
95th Avenue	Springwood Drive	Ash Avenue	
79th Avenue	Tigard Street	O'Mara Street	
74th/72nd Avenue	Fonner Street	Canterbury Lane	

Changes from Collector or Local designation to Neighborhood Route (see Figure 8-4)

Metzger Area	**South Tigard**	**Central Tigard**	**North Dakota Area**	**Southwest**
Washington Drive	Sattler Street	Shady Lane	North Dakota Street	Horizon Boulevard
Cedarcrest Street	Pinebrook Street	95th Avenue	Springwood Drive	Creekshire Drive
82nd Avenue	Alderbrook Drive	Dakota Street	115th Avenue	Fern Street
Locust Street	92nd Avenue	90th Avenue	Tigard Street	Ascension Drive
74th Avenue	Inez Street	98th Avenue	Tigard Drive	Windsong Court
69th Avenue	93rd Avenue	Commercial Street	116th Avenue	Northview Drive
Alfred Street	97th Avenue	Tigard Street	Ann Street	Mistletoe Drive
Ventura Court	Murdock Street	Grant Avenue	Katherine Street	135th Avenue
Ventura Drive	98th Avenue	Johnson Street	125th Avenue	Essex Drive
72nd Avenue	100th Avenue	Brookside Avenue	Karen Street	Benchview Terrace
80th Avenue	103rd Avenue	Watkins Avenue	127th Avenue	132nd Avenue
Pine Street	Canterbury Lane	Park Street	128th Avenue	Greenfield Drive
75th Street	Highland Drive	110th Avenue	Winter Lake Drive	Menlor Lane
Spruce Street	Summerfield Drive	115th Avenue	130th Avenue	Sunrise Lane
78th Avenue	92nd Avenue	Fonner Street	Brittany Drive	150th Avenue
69th Avenue	108th Avenue	116th Avenue	Morning Hill Drive	Uplands Drive
East Tigard	Riverwood Lane	Howard Drive	Falcon Rise	141st Avenue
Fanno Creek Drive	Copper Creek Drive	Garrett Street	131st Avenue	Woodhue Street
79th Avenue	Millen Drive	Frewing Street		Tewkesbury Drive
Ross Street	River Drive	Ash Avenue		Barrington Terrace
Ashford Street	Tualatin Drive	O'Mara Street		Westminster Drive
		Edgewood Street		Peachtree Drive
				133rd Avenue

The proposed changes in functional classification on Durham Road, Murray Boulevard, Gaarde Street, 72nd Avenue, Greenburg Road and Beef Bend Road affect Washington County roadways. These proposed changes have been discussed with County staff and the County is in the process of reviewing these changes.

DKS *Associates*

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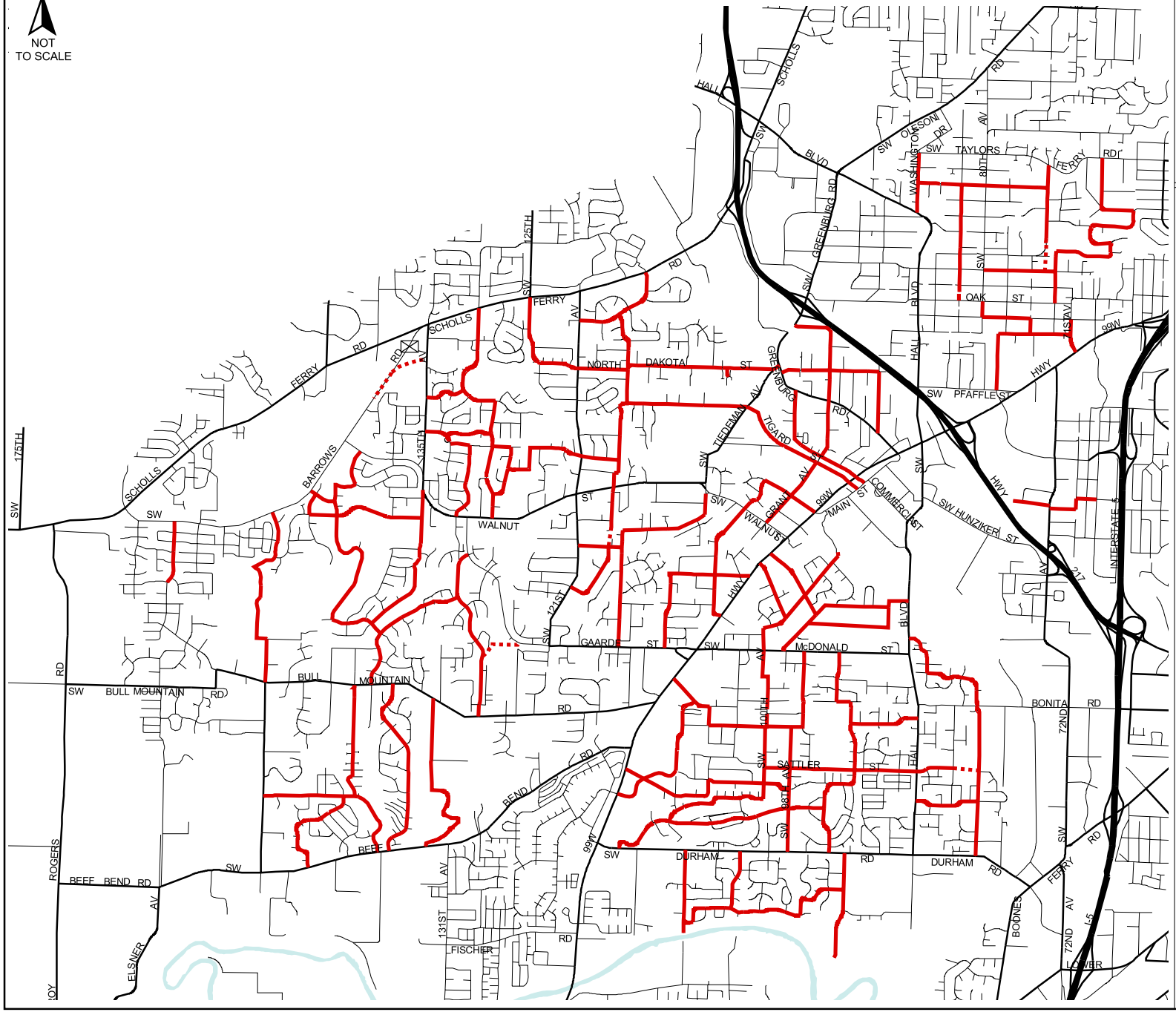

CITY OF TIGARD
OREGON

Transportation Systems Plan

Legend

- Road Closure
- Neighborhood Routes
  - Proposed
  - Planned

Figure 8-4
Proposed Neighborhood Routes

Characteristics of Streets for each Functional Classification

The design characteristics of streets in Tigard were developed to meet the function and demand for each facility type. Because the actual design of a roadway can vary from segment to segment due to adjacent land uses and demands, the objective was to define a system that allows standardization of key characteristics to provide consistency, but also to provide criteria for application that provides some flexibility, while meeting standards. Figures 8-5 to 8-10 depict sample street cross-sections and design criteria for arterials, collectors, neighborhood routes and local streets. Figure 8-5 shows the Existing Tigard Standard Cross-Sections, Figure 8-6 and 8-7 shows Washington County's Standard Cross-Sections (these apply to Washington County owned roadways) and Figures 8-8 through 8-10 show the *proposed* Tigard Standard Cross-Sections. Planning level right-of-way needs can be determined utilizing these figures and Table 8-2 and the lane geometry outlined later in this chapter. Specific right-of-way needs will need to be monitored continuously through the development review process to reflect current needs and conditions[6] (that is to say that more specific detail may become evident in development review which requires improvements other than these outlined in this 20 year general planning assessment of street needs).

The analysis of capacity and circulation needs for Tigard outlines several roadway cross sections. The most common are 2, 3 and 5 lanes wide. Where center left turn lanes are identified (3 or 5 lane sections), the actual design of the street may include sections without center turn lanes (2 or 4 lane sections[7]) or with median treatments, where feasible. The actual treatment will be determined within the design and public process for implementation of each project. The plan outlines requirements which will be used in establishing right-of-way needs for the development review process. The right-of-way (ROW) requirements for arterial and collector streets on the Washington County system are 50-74 feet for collector streets, 90 feet for three-lane arterials and 90-122 feet for four-to-seven-lane arterials[8].

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[6] For example, designations by Metro, ODOT and Washington County all play a role in the ROW determination.

[7] For example, adjacent to environmentally sensitive or physically constrained areas.

[8] Washington County Uniform Road Improvement Design Standards, Ordinance No. 524, Adopted July 28, 1998, pages 13-18.

Table 8-2
Proposed Street Characteristics

Vehicle Lane Widths: (minimum widths)	Truck Route = 12 feet Bus Route = 11 feet Arterial = 12 feet Collector = 11 feet Neighborhood = 10 feet Local = 9[9] to 10 feet Turn Lane = 12 feet[10]
On-Street Parking:	8 feet[11]
Bicycle Lanes: (minimum widths)	New Construction = 6 feet Reconstruction = 5 to 6 feet
Curb Extensions for Pedestrians:	Consider on any Pedestrian Master Plan Route
Sidewalks: (minimum width)	Local = 5 feet[12] Neighborhood = 5 feet[12] Collector = 6 to 8[13] feet Arterial = 6 to 10[13] feet
Landscape Strips:	Residential/Neighborhood = Required Collector/Arterial = Required
Medians:	5-Lane = Required 3-Lane = Optional
Neighborhood Traffic Management:	Local = Should not be necessary Neighborhood = Should Consider Collectors = Under Special Conditions Arterials = Only under Special Conditions
Transit:	Arterial/collectors = Appropriate Neighborhood = Only in special circumstances
Turn Lanes:	When Warranted[14]
Access Control:	See later section for Arterials and Collectors

[9] 9 foot lanes would only be used in conjunction with on-street parking.

[10] In constrained conditions on collectors, neighborhood and local routes, a minimum width of 10 feet may be considered (except on bus routes)

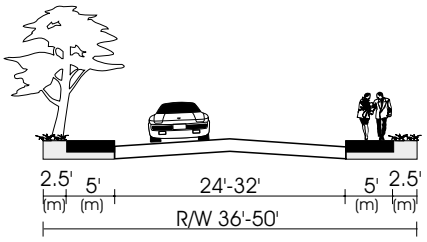
[11] For 32 foot streets, the City recognizes that there will not be 20 feet of unobstructed pavement.

[12] 5 foot with landscape strip, 6 foot against curb.

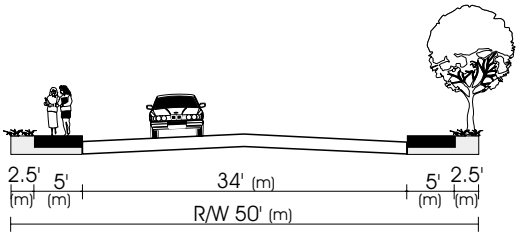
[13] Larger sidewalks than minimums should be considered for areas with significant pedestrian volumes. In commercial areas where pedestrian flows of over 100 pedestrians an hour are present or forecast, specific analysis should be conducted to size sidewalks appropriately for safe movement.

[14] Turn lane warrants should be reviewed using Highway Research Record, No. 211, NCHRP Report No. 279 or other updated/superseding reference.

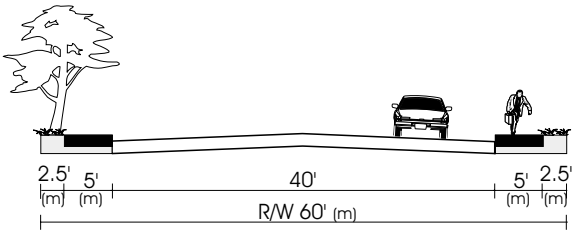
Local Street
Residential



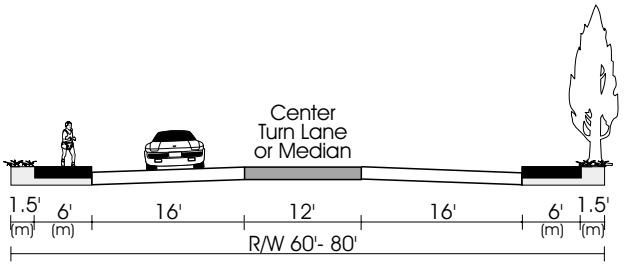
Local Street
Commercial & Industrial



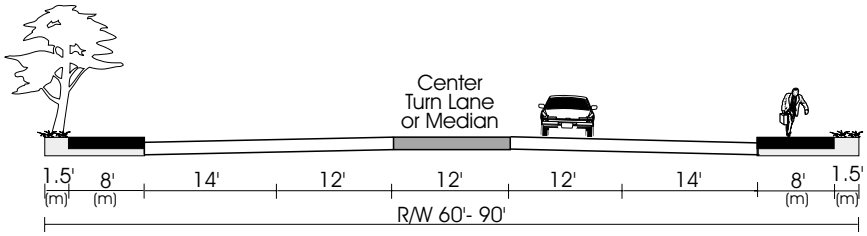
Minor Collector



Major Collector



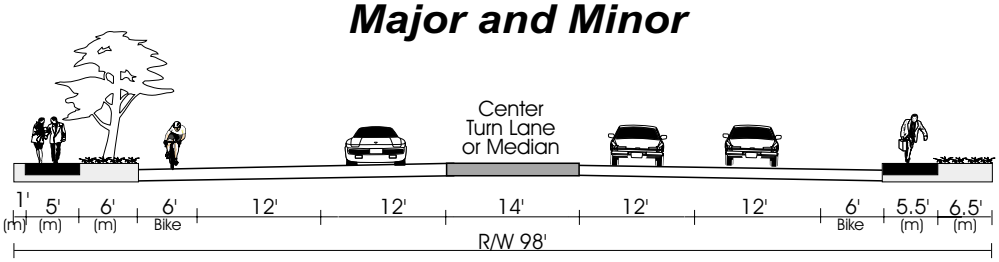
Arterial



(m) - Minimum Required Width

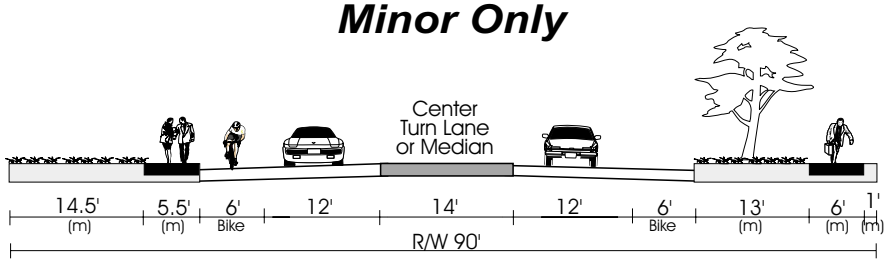
Figure 8-5
EXISTING
TYPICAL STREET CROSS SECTIONS

Arterial
Major and Minor



5 Lanes

Arterial
Minor Only

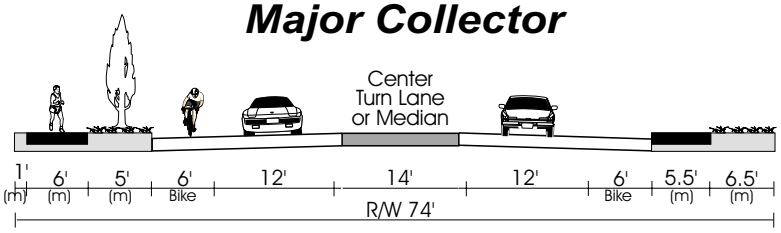


3 Lanes

(m) - Minimum Required Width

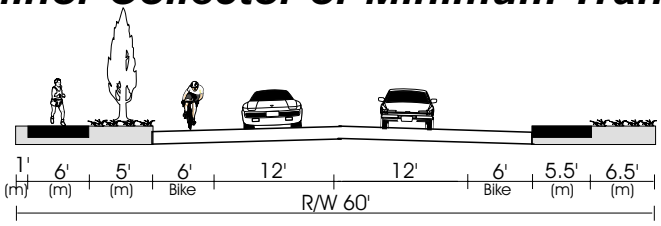
Figure 8-6
WASHINGTON COUNTY ARTERIAL
TYPICAL STREET CROSS SECTIONS

Major Collector



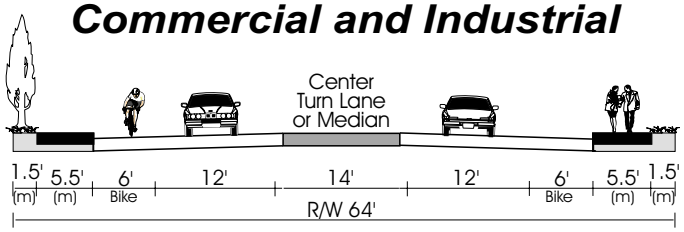
3 Lanes

Minor Collector or Minimum Transit



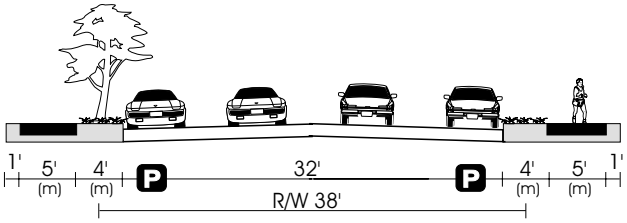
2 Lanes

Commercial and Industrial



3 Lanes

Local Street (Standard)



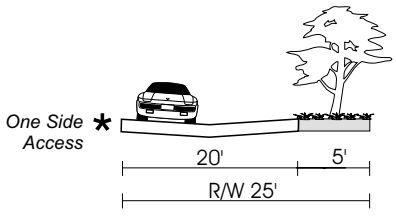
Parking Both Sides

(m) - Minimum Required Width

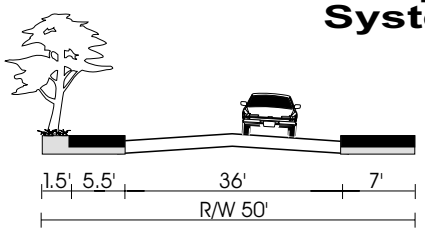
P - *On-street Parking*

Figure 8-7
WASHINGTON COUNTY
TYPICAL STREET CROSS SECTIONS

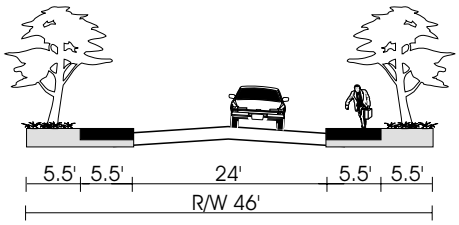
CITY OF TIGARD
Transportation System Plan



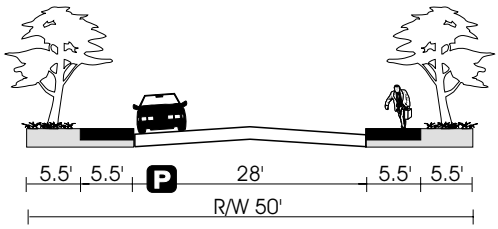
Alley
(No parking)



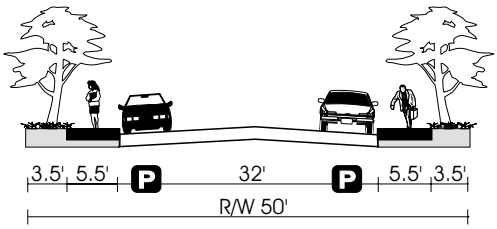
Industrial/Commercial Local



Cul-de-sac/Residential Local Street
<200 vpd
(No parking)



Residential Local Street/Cul-de-sac
One Side On-street Parking
<500 vpd



On-street Parking
<1500 vpd *

If parking on both sides, block length not to exceed 600 feet

Notes:

1. *Selection of placement of sidewalk and planter strip specific to application.*
2. *Width of curb is included in sidewalk width when adjacent to street.*
3. *Samples show the desirable applications given number of lanes; minimum standards can be applied case by case.*
4. *Actual width of street and sidewalk area can be adjusted within R/W based on modal priorities and adjacent land use.*
5. *Volume guides represent estimated Full Buildout Conditions, not just existing or project needs.*
6. *The 36' street shall be used in any area adjacent to commercial or industrial zoning. Sidewalk would be 7' curb tight in Commercial areas and 5.5' for Industrial areas (cross section shows both samples).*
7. *Where existing street curb to curb widths vary from those shown, the minimum length of new cross section should be (or have the potential to be) 500 feet contiguous.*

P *- On-street Parking*

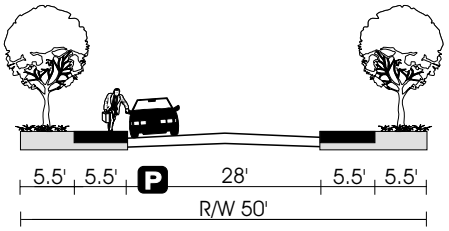
<1500 vpd *- Guide for Traffic Volume Per Day (does not require conversion of existing routes)*

* *Where volume exceeds 1500 vpd, this cross section may still be utilized however land use actions or roadway projects impacting such streets may require additional connectivity to reduce volume and/or neighborhood traffic management measures to reduce impacts.*

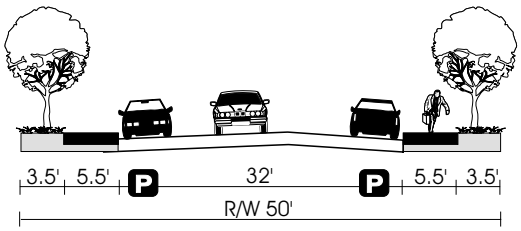
Criteria

Vehicle Lane Widths: *(minimum widths)*	*9 to 10 ft.*
On-Street Parking	*8 ft.*
Sidewalks: *(minimum width)*	*5 ft.*
Landscape Strips:	*Where Appropriate*
Neighborhood Traffic Management:	*Should not be necessary (under special conditions & over 1500 vpd)*

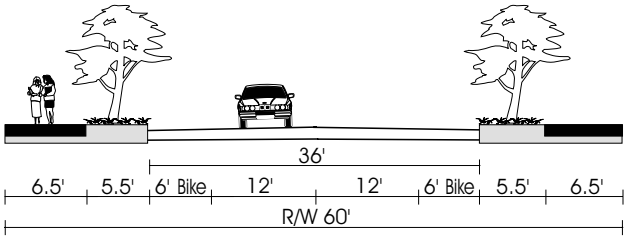
Figure 8-8
ALLEY, CUL-DE-SAC AND LOCAL STREET SAMPLE STREET CROSS SECTIONS REQUIRED ROW WIDTH



No Parking on One Side



With Parking on Both Sides



With Bike Lanes / No Parking

Notes:

1. *Selection of placement of sidewalk and planter specific to application.*
2. *Width of curb is included in sidewalk width when adjacent to street.*
3. *Samples show the desirable applications given number of lanes; minimum standards can be applied case by case.*
4. *Actual width of street and sidewalk area can be adjusted within R/W based on modal priorities and adjacent land use.*
5. *These are guidelines for future neighborhood route development and does not require changes/conversion to existing streets.*

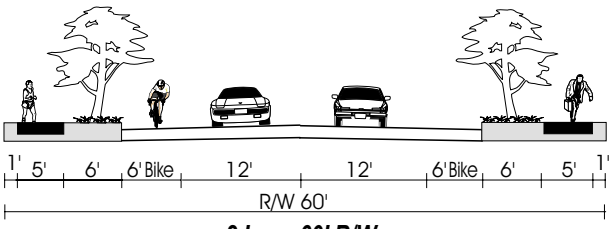
Criteria

Vehicle Lane Widths: *(minimum widths)*	*9-10 ft.*
On-Street Parking	*8 ft.*
Curb Extensions for Pedestrians:	*Consider on Pedestrian Routes*
Sidewalks: *(minimum width)*	*5 ft.*
Landscape Strips:	*Where Appropriate*
Neighborhood Traffic Management:	*Appropriate when Warranted*

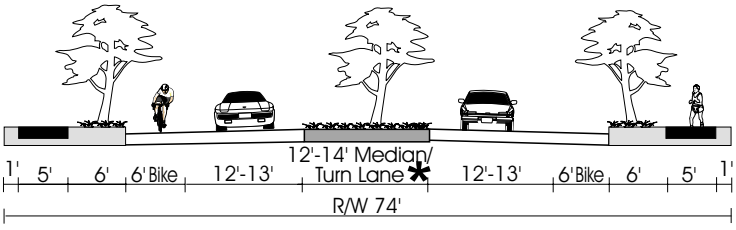
P - *On-street Parking*

Figure 8-9
NEIGHBORHOOD
SAMPLE STREET CROSS SECTIONS
REQUIRED ROW WIDTH

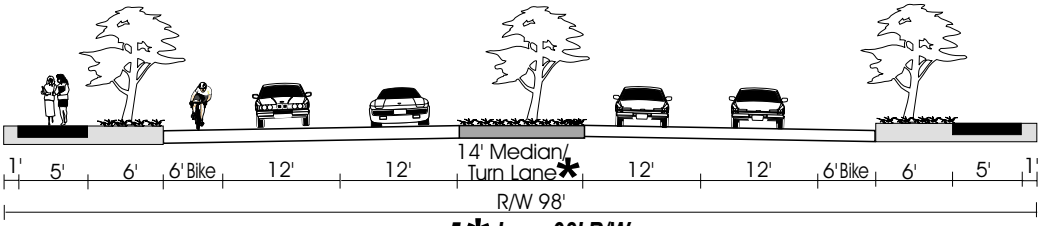
CITY OF TIGARD
Transportation System Plan



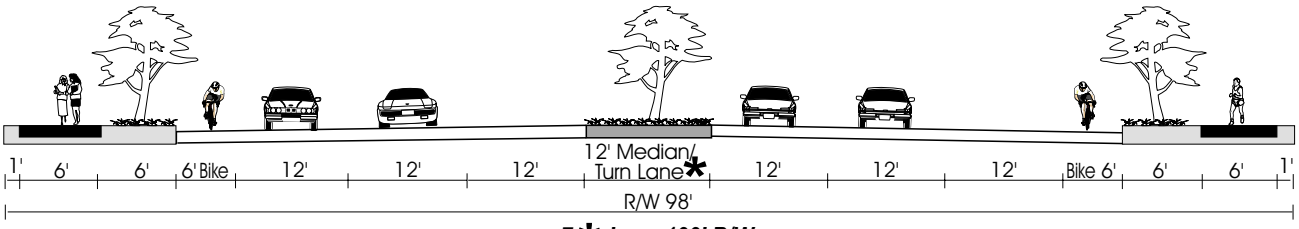
2 Lane 60' R/W



3* Lane 74' R/W



5* Lane 98' R/W



7* Lane 122' R/W

Criteria

Vehicle Lane Widths: *(minimum widths)* ***Collector***	*Truck Route = 12 ft.* *Bus Route = 12 ft.* *11 ft. (12 ft. Preferred)* *10-11 ft.*
On Street Parking:	*None (with few existing exceptions)*
Bicycle Lanes: *(minimum widths)*	*New Construction = 6 ft.* *Reconstruction = 5 to 6 ft.*
Sidewalks: *(minimum width)*	*5-13 ft. Consider Curb Extensions on Ped Routes*
Landscape Strips:	*Required*
Medians:	*5/7 Lane = Required* *3 Lane = Optional*
Neighborhood Traffic Management:	*Only Under Special Conditions: Selected Measures*

Figure 8-10
ARTERIAL AND COLLECTOR
SAMPLE STREET CROSS SECTIONS
REQUIRED ROW WIDTH

* *Note that, sidewalk widths above 6 ft. may require additional right-of-way. Where appropriate, the median/lane may not be provided resulting in 2,4 and 6 lane cross sections. The removal of the center turn lane must consider both safety and pedestrian needs.*

Wherever arterial or collectors cross each other, planning for additional right-of-way to accommodate turn lanes should be considered within 500 feet of the intersection. Figure 8-11 summarizes the Tigard streets that are anticipated within the TSP planning horizon to require right-of-way for more than two lanes. Planning level right-of-way needs can be determined utilizing Figure 8-11 and the lane geometry outlined later in this chapter. Specific right-of-way needs will need to be monitored continuously through the development review process to reflect current needs and conditions. This will be necessary since more specific detail may become evident in development review which requires improvements other than these outlined in this 20 year general planning assessment of street needs.

These cross sections are provided for guiding discussions that will update the City of Tigard *Public Improvement Design Standards for Public Works Construction*. There is an on-going discussion at the regional level regarding street cross sections. Several of the major streets in Tigard are maintained and operated by Washington County or ODOT. Metro has specified Regional Street Design designations in their draft of the RTP[15]. These designations change over the length of the road. The City of Tigard will need to coordinate with regional agencies to assure consistency in cross section planning as the County Transportation Plan and the Metro Regional Transportation Plan move forward. The designations are summarized in Table 8-3. The Metro definitions for their designations are provided in the Appendix.

Table 8-3
Metro Regional Street Design and Motor Vehicle Designations

Roadway	Regional Street Design	Motor Vehicle Classification
ORE 217	Freeway	Principal Arterial (Freeway)
I-5	Freeway	Principal Arterial (Freeway)
ORE 99W	Regional St./Regional Boulevard	Major Arterial
Scholls Ferry Road	Regional St./Regional Boulevard	Major Arterial
Greenburg Road	Regional St./Regional Boulevard	Major Arterial
Hall Boulevard (Scholls Ferry to Greenburg)	Regional Boulevard	Major Arterial
Hall Boulevard (Greenburg to South City Limits)	Community St./Community Blvd	Minor Arterial
Durham Road	Community Street	Minor Arterial
72nd Avenue	Urban Road	Minor Arterial
Upper Boones Ferry Road	Urban Road	Minor Arterial
Beef Bend Road (West of City Limits to Scholls Ferry)	Rural Road	Rural Arterial
Dartmouth Street	Community Street	Collector of Regional Significance
Gaarde/Walnut/Murray	Community Street	Collector of Regional Significance
McDonald Street	Community Street	Collector of Regional Significance
Beef Bend Rd (East of City Limits)	Community Street	Collector of Regional Significance

NOTE: Refer to Metro's RTP Policy Chapter for background on guidelines for streets, 1997.

[15] Refer to Regional Street Design System, Preliminary Draft RTP, Metro, June 17, 1999.

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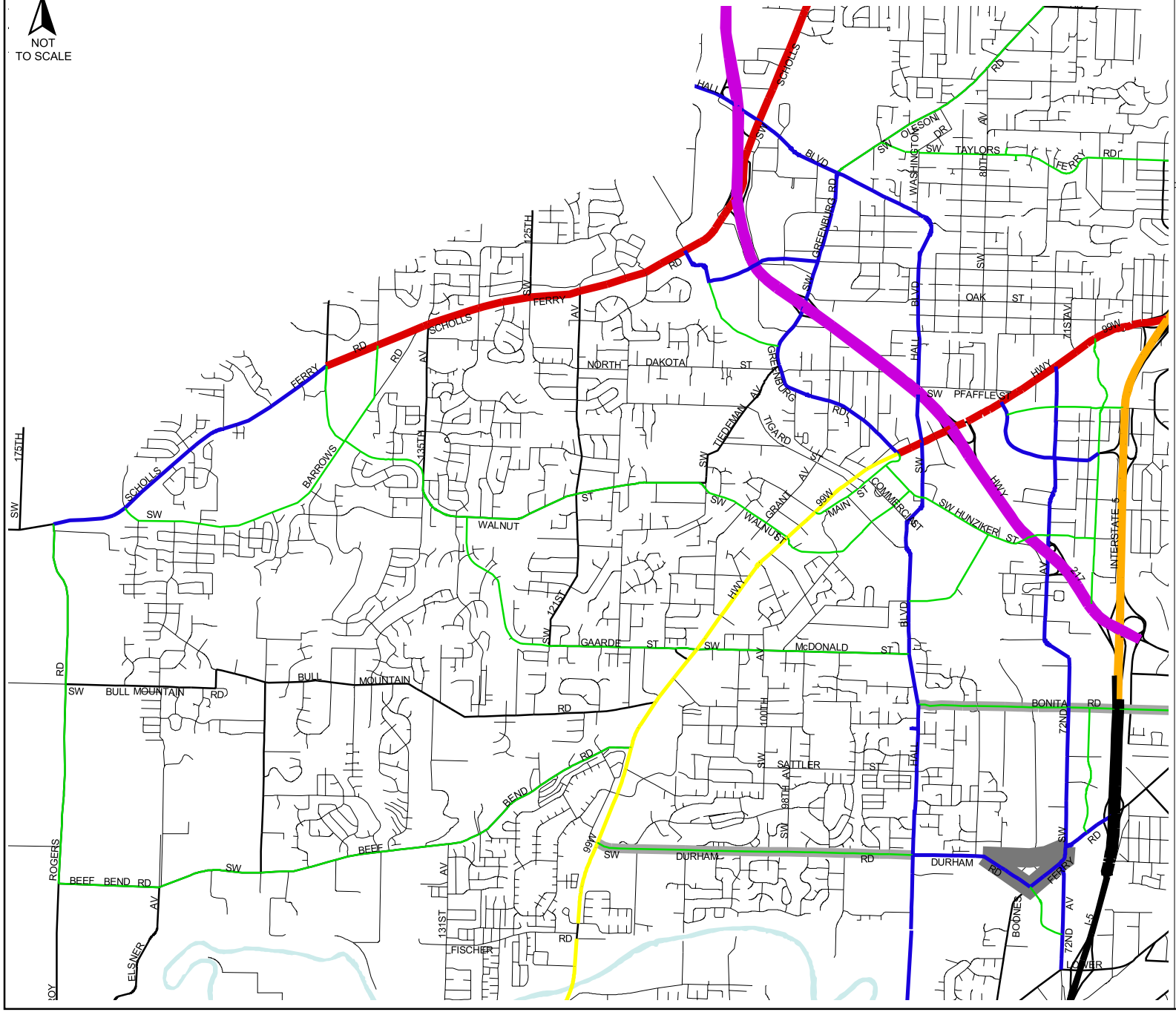

CITY OF TIGARD
OREGON

Transportation Systems Plan

Legend

Planned Right of Way

- 8 Lanes
- Added Person Capacity Corridor*
- 7 Lanes
- 6 Lanes
- 5 Lanes
- 4/5 Lanes
- 2/3 Lanes
- SP**
- Corridor Alingment Study Area

* Assume eight lanes for setbacks

** Preserve ROW for 5 lanes in Future

Note: All Arterial/Arterial, Arterial/Collector and Collector/Collector intersections should plan for needed ROW for turn lanes within 500 feet of the intersection.

2/3 and 4/5:
Two or four lanes may be used for segments where environmental constraints limit roadway and access is controlled to eliminate left turn lane need.

Figure 8-11
Future Streets Where ROW is Planned for More Than Two Lanes

Connectivity/Local Street Plan

Much of the local street network in Tigard is already existing and, in many cases, fairly well connected. In other words, multiple access opportunities exist for entering or exiting neighborhoods. However, there are a number of locations in Tigard where, due to the lack of connection points, the majority of neighborhood traffic is funneled onto one single street. This type of street network results in out-of-direction travel for motorists and an imbalance of traffic volumes that impacts residential frontage. The outcome can result in the need for wider roads, traffic signals and turn lanes (all of which negatively impact traffic flow and degrade safety). By providing connectivity between neighborhoods, out-of-direction travel and vehicle miles traveled (VMT) can be reduced, accessibility between various modes can be enhanced and traffic levels can be balanced out between various streets. Several goals and policies established by this TSP are intended to accomplish these objectives.

In Tigard, some of these local connections can contribute with other street improvements to mitigate capacity deficiencies by better dispersing traffic. Several roadway connections will be needed within neighborhood areas to reduce out of direction travel for vehicles, pedestrians and bicyclists. This is most important in the sub-areas to the west where a significant amount of new development is possible (i.e. Bull Mountain area). In many areas of Tigard, most of the land is built out. Figures 8-12 through 8-17 show the proposed Local Street Connectivity Plans for Tigard. In most cases, the connector alignments are not specific and are aimed at reducing potential neighborhood traffic impacts by better balancing traffic flows on neighborhood routes. The arrows shown in the figures represent potential connections and the general direction for the placement of the connection. In each case, the specific alignments and design will be better determined upon development review. The criteria used for providing connections is as follows[16]:

- Every 330 feet, a grid for pedestrians and bicycles
- Every 530 feet, a grid for automobiles

To protect existing neighborhoods from potential traffic impacts of extending stub end streets, connector roadways should incorporate neighborhood traffic management into their design and construction. Neighborhood traffic management is described later in this chapter. All stub streets should have signs indicating the potential for future connectivity.

The arrows shown on the local connectivity figures indicate priority connections only. Topography, railroads and environmental conditions limit the level of connectivity in Tigard. Other stub end streets in the City's road network may become cul-de-sacs, extended cul-de-sacs or provide local connections. Pedestrian connections from the end of any stub end street that results in a cul-de-sac should be considered mandatory as future development occurs. The goal would continue to be improved city connectivity for all modes of transportation.

[16] The Regional Transportation Plan calls for pedestrian/bicycle connectivity every 330 feet and motor vehicle connectivity every 530 feet for vacant areas of residential and mixed use zoning greater than five acres.

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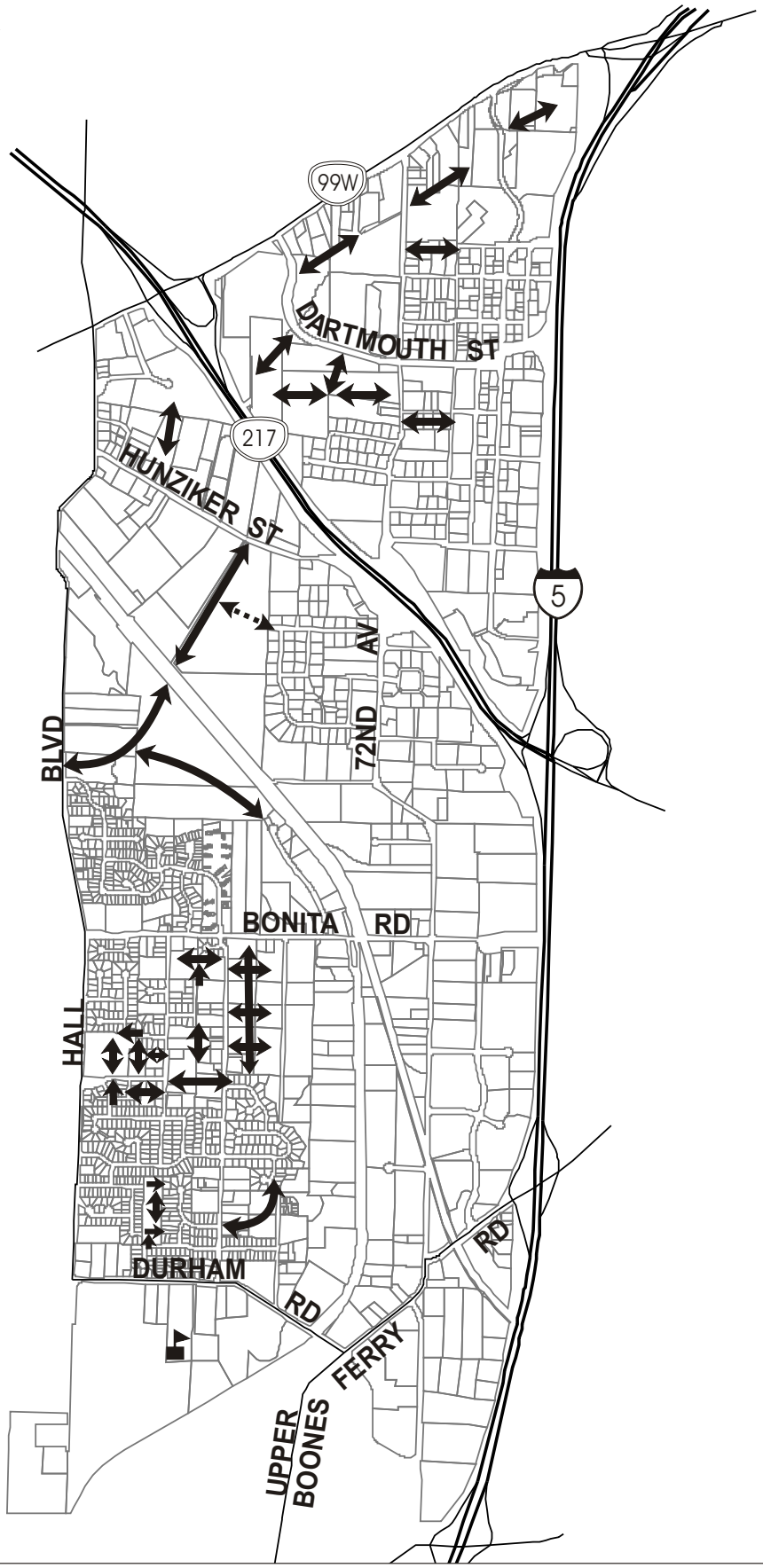
CITY OF TIGARD
Transportation System Plan



Legend
- Stub End Street
- Pedestrian Connection
- School Site

Figure 8-12
LOCAL STREET CONNECTIVITY
East Tigard

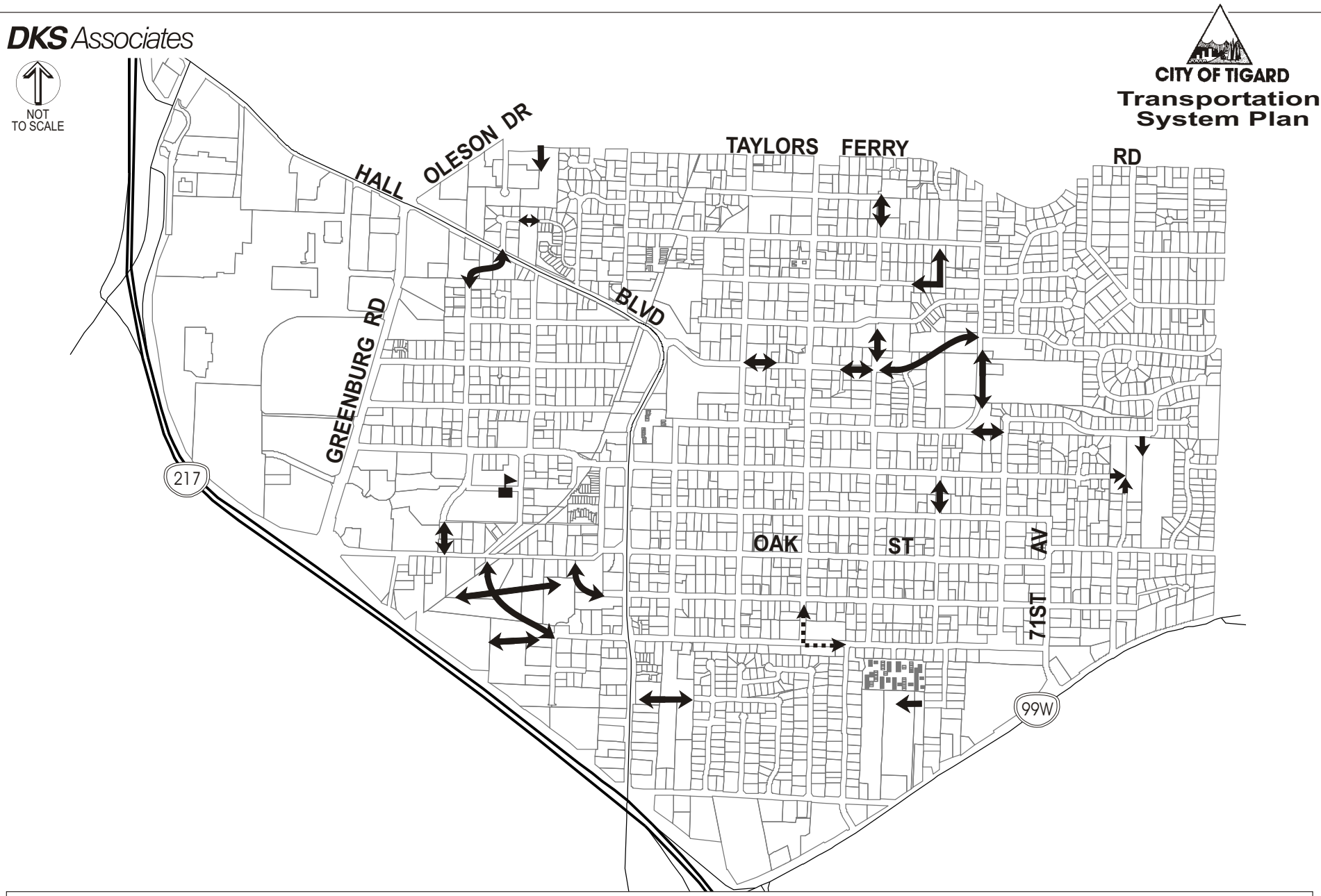


Figure 8-13
LOCAL STREET CONNECTIVITY
Metzger

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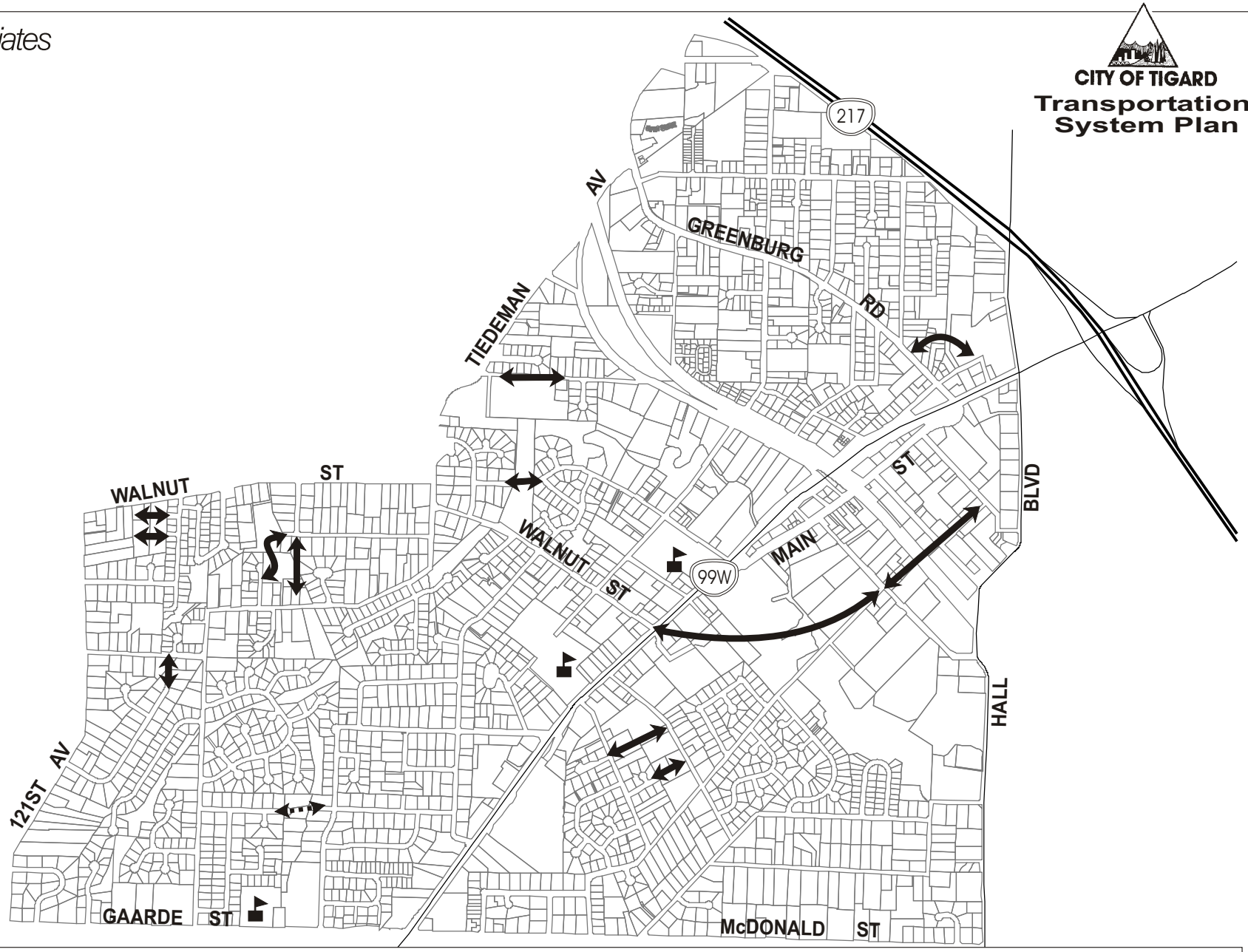
Transportation System Plan



Legend
- Stub End Street
- Pedestrian Connection
- School Site

Figure 8-14
LOCAL STREET CONNECTIVITY
Central Tigard

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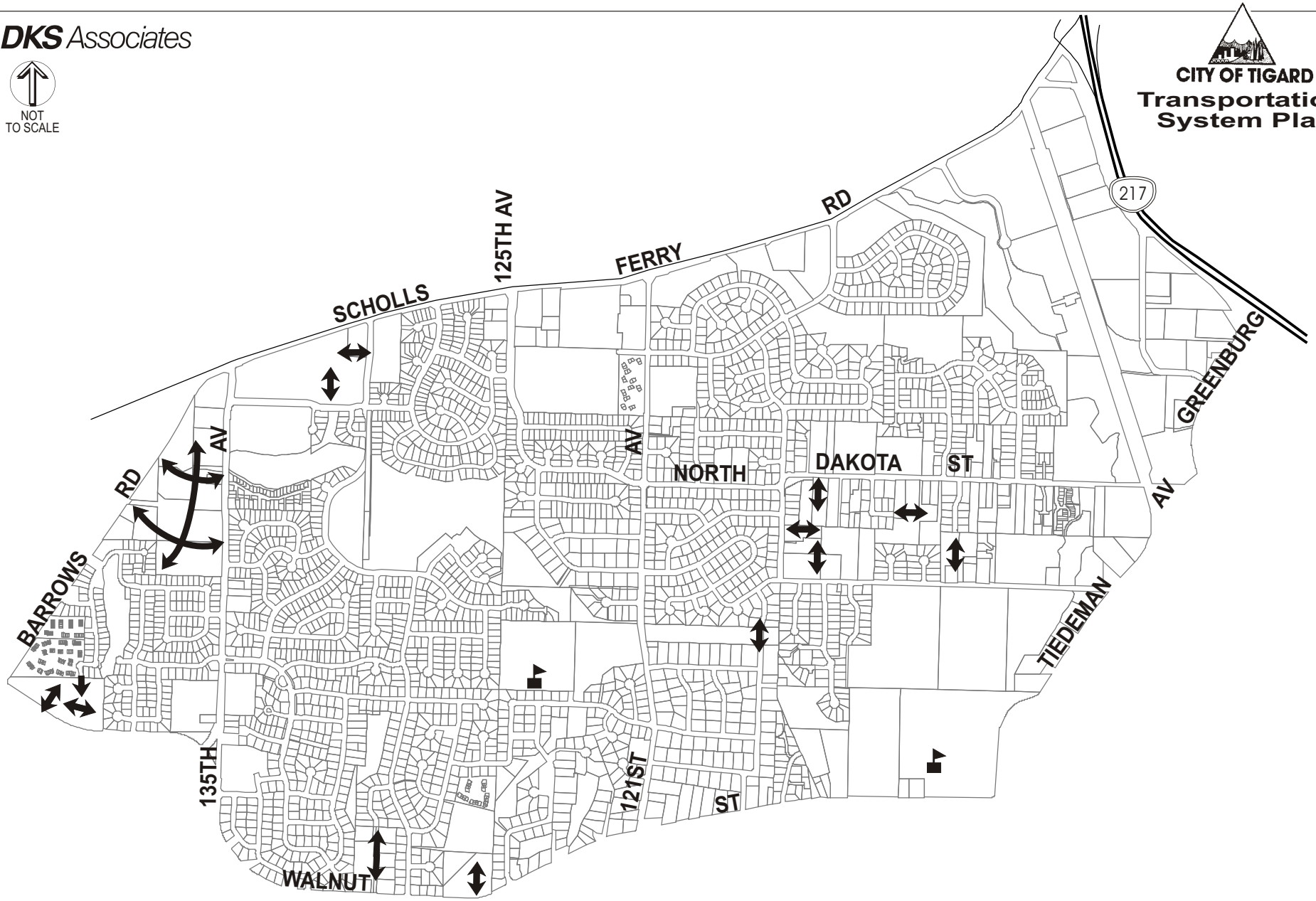
CITY OF TIGARD
Transportation System Plan



Legend

- Stub End Street
- Pedestrian Connection
- School Site

Figure 8-15
LOCAL STREET CONNECTIVITY
North Dakota

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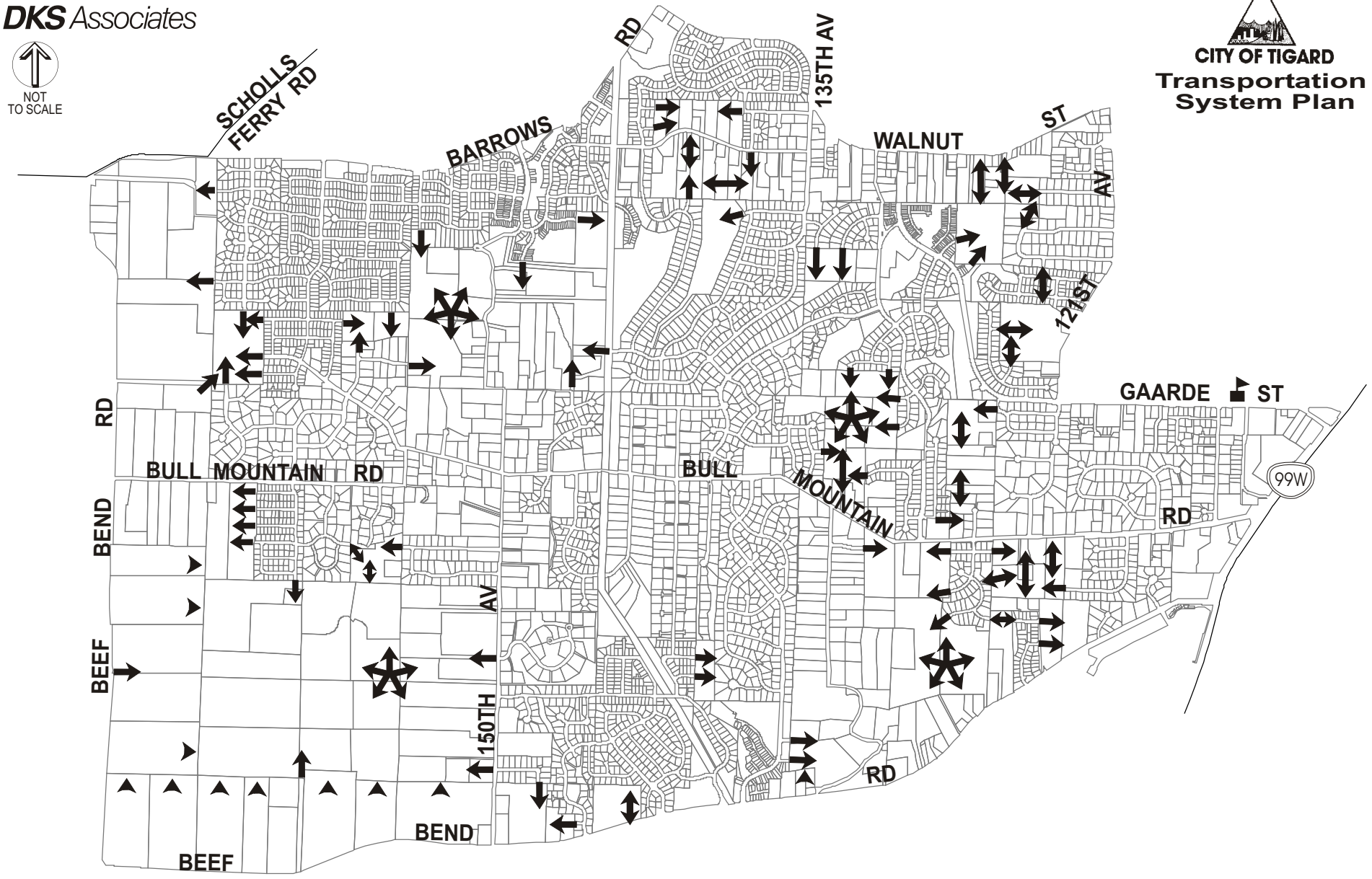
CITY OF TIGARD
Transportation System Plan



Legend
- Stub End Street
- Direction of Access
- Pedestrian Connection
- School Site

Figure 8-16
LOCAL STREET CONNECTIVITY
Southwest Tigard

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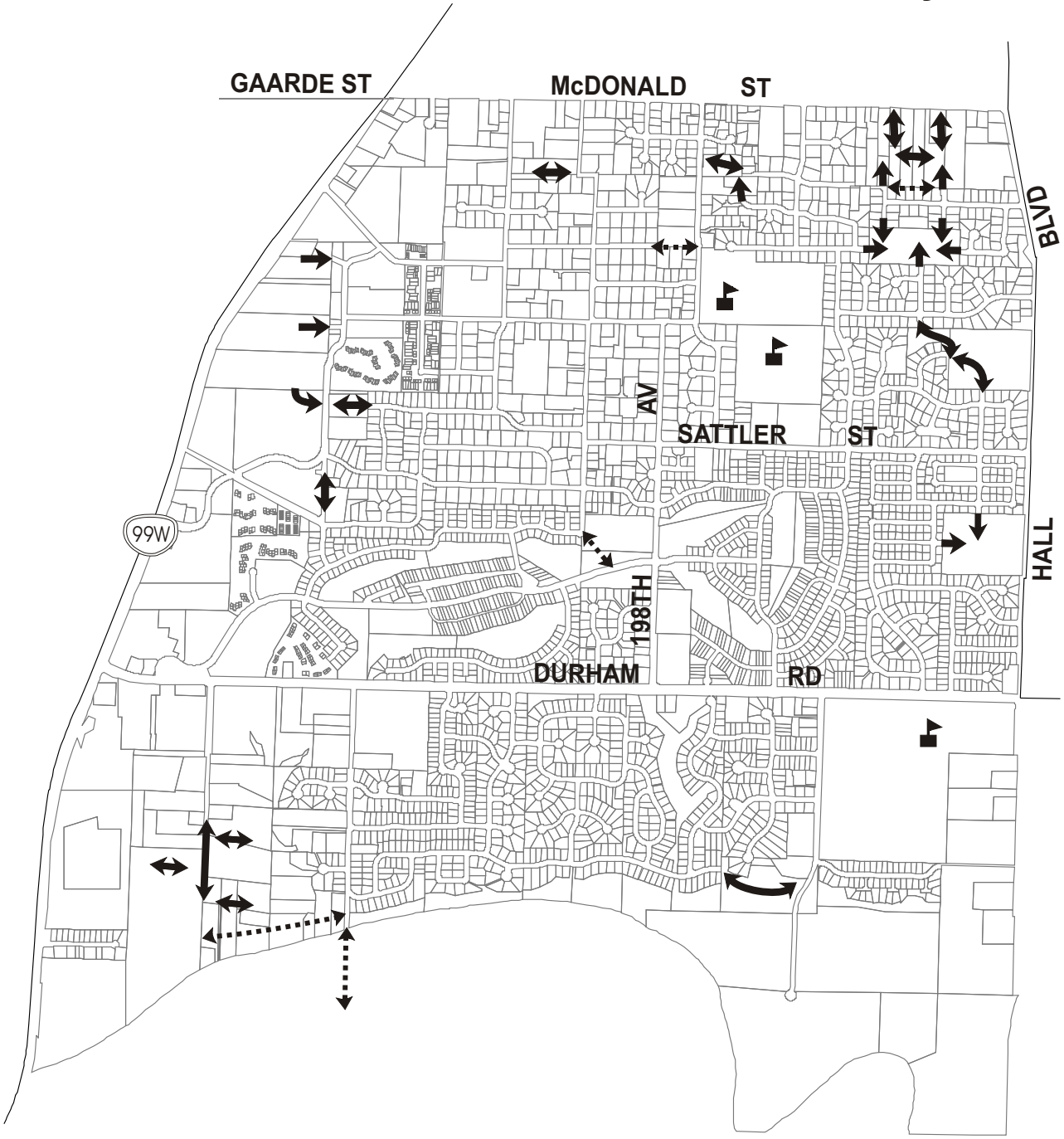
CITY OF TIGARD
Transportation System Plan



Legend
- Stub End Street
- Pedestrian Connection
- School Site

Figure 8-17
LOCAL STREET CONNECTIVITY
South Tigard

CIRCULATION AND CAPACITY NEEDS

The motor vehicle capacity and circulation needs in Tigard were determined for existing and future conditions. The process used for analysis is outlined below, followed by the findings and recommendations of the analysis. The extent and nature of the street improvements for Tigard are significant. This section outlines the type of street improvements that would be necessary as part of a long range master plan. Phasing of implementation will be necessary since all the improvements cannot be done at once. This will require prioritization of projects and periodic updating to reflect current needs. It should be understood that the improvements outlined in the following section are a guide to managing growth in Tigard, defining the types of right-of-way and street needs that will be required as development occurs.

Strategies

A series of strategies were developed to address the future motor vehicle needs of Tigard. Each of these strategies were discussed by the TSP Task Force and prioritized. The initial prioritization was reviewed and refined following discussion about the implications of the high priority strategies. The actual strategy selected is a prioritization of the highest priority strategies. The following listing reflects the initial prioritization of strategies.

- Promote Regional Circulation (I-5, ORE 217, ORE 99W)
- Improve Local Street Circulation (connectivity)
- Provide Additional Street System Capacity to LOS D[17] (turn lanes, signals, widening, new roads)
- Improve Operation of Existing System (signal coordination, intelligent transportation systems, neighborhood traffic management)
- Transportation Demand Management (telecommuting, alternative modes, pricing)
- Change Land Use to Promote Alternative Modes Use
- Improve Access Control to increase capacity
- Change Level of Service Definitions

Model Forecasts

Existing conditions were identified in Chapter 3. Future capacity needs were developed using a detailed travel demand forecast tool, based on the Metro regional travel demand model. This detailed model more accurately reflects access and land use in Tigard than the regional travel demand model. Evening peak hour traffic volumes were forecast for the future (modified year 2015 buildout) scenario for the Tigard area. This 2015 forecast included the highest level of transit service given regional funding constraints. It also assumes that Transportation Demand Management (TDM) will occur. The initial 2015 test was performed on a street network that included existing roads, plus those improvements which are currently funded and would likely be implemented before the 2015 scenario is reached. The most significant of these improvements in Tigard include the following:

[17] Level of service D as defined by the Highway Capacity Manaul.

- ORE 217 widened one additional lane each direction and the ORE 217/I-5 interchange improvements
- Gaarde Street linking from ORE 99W to Murray Boulevard
- Walnut Street improved to three lanes
- Dartmouth Street as five lanes from ORE 99W to I-5
- Hall Boulevard as a continuous three lane roadway with improvements at ORE 99W

The modified 2015 forecast for Tigard is unique in that it reflect greater land use in Tigard than the Metro 2015 forecast (reflective of a build out-like scenario). 2015 was used as a base rather than the 2020 because of the greater Tigard trip generation and detailed network included in the 2015 forecast. A separate 2020 forecast was done for a sensitivity analysis of recommended motor vehicle improvements to validate their need.

Future Needs

Future transportation conditions were evaluated in a similar manner to existing conditions. Improvements to intersections, roadways between intersections and brand new or extended facilities were considered and a package of recommended improvements was determined. Where level of service conditions approached level of service E or volume-to-capacity ratio of 0.90 or above, improvements were initially considered. The final conditions for mitigation were set at conditions below V/C of 1.0 and level of service E. Table 8-4 summarizes the intersection levels of service under year 2015 base future conditions and the recommended mitigated scenario.

In summary, nearly half of the study intersections fail in the future, even with funded roadway improvements. The extent of failure is so severe that it is unlikely that the land use scenario assumed for the modified 2015 forecast would be achieved with the extent of congestion. Because of this many alternatives were evaluated in developing the recommended set of mitigation measures for the TSP. The following sections explore the options and the findings for each alternative.

Table 8-4
2015 Intersection Level of Service
PM Peak Hour

Intersection	**2015 Base**	**2015 Mitigated**
Signalized Intersections (future)	*Delay LOS V/C*	
Davies/Scholls Ferry Road	>60.0 F >1.0	33.2 C 0.89
Barrows (E)/Scholls Ferry Road	11.1 B 0.73	15.3 B 0.93
North Dakota/125th/Scholls Ferry Road	>60.0 F >1.0	38.7 D 0.95
Nimbus/Scholls Ferry Road	>60.0 F >1.0	44.7 D 0.94
121st/Walnut	>60.0 F >1.0	33.0 C 0.87
Greenburg/Oleson/Hall	>60.0 F >1.0	46.8 D 0.91
Greenburg/Washington Square Road	>60.0 F >1.0	51.4 D 0.92
Greenburg/Locust	43.6 D 1.0	29.9 C 0.91
Hall/Locust	32.7 C 0.86	25.5 C 0.79
Greenburg/ORE 217 WB Ramps	27.8 C 0.74	29.3 C 0.65

Intersection	**2015 Base**	**2015 Mitigated**
Signalized Intersections (future)	*Delay LOS V/C*	
Greenburg/ORE 217 EB Ramps	29.1 C 0.72	23.4 C 0.58
Greenburg/Tiedeman	53.1 D >1.0	39.6 D 0.96
Main/Greenburg/ORE 99W	60.4 E 0.96	51.3 D 0.88
Hall/Oak	56.2 E >1.0	33.4 C 0.88
Hall/ORE 99W	>60.0 F >1.0	54.7 D 0.95
ORE 217 NB Ramps/ORE 99W	28.8 C 0.95	18.0 B 0.79
ORE 217 SB Ramps/ORE 99W	40.7 D 0.99	31.6 C 0.86
Main/Johnson/ORE 99W	23.1 C 0.80	16.4 B 0.75
Dartmouth/ORE 99W	>60.0 F >1.0	52.1 D 0.96
72nd/ORE 99W	41.7 D 0.88	53.8 D 0.92
68th/ORE 99W	>60.0 F >1.0	48.3 D 0.94
72nd/Dartmouth	>60.0 F >1.0	31.3 C 0.70
68th/Dartmouth	>60.0 F >1.0	21.4 C 0.72
72nd/Hampton	34.0 C 0.90	52.8 D 0.84
68th/Atlanta/Haines	29.9 D 0.92	16.5 B 0.61
Hall/Hunziker	>60.0 F >1.0	40.7 D 0.88
Hall/Burnham	19.6 B 0.75	21.0 C 0.65
ORE 217 SB Ramps/72nd/Varns	65.4 E 1.0	31.0 C 0.83
72nd/Bonita	>60.0 F >1.0	49.9 D 0.97
Hall/McDonald	47.0 D 0.99	36.1 D 0.93
Hall/Bonita	33.5 C 0.86	45.0 D 0.82
72nd/Carman	50.1 D 0.97	43.7 D 0.95
I-5 SB Ramps/Carman	>60.0 F >1.0	58.9 E 1.0
72nd/Upper Boones Ferry	51.4 D 1.0	49.8 D 0.97
72nd/Durham	20.6 C 0.75	9.0 A 0.50
I-5 NB Ramps/Carman	>60.0 F >1.0	47.1 D 0.91
Upper Boones Ferry/Durham	62.3 E >1.0	31.0 C 0.85
Upper Boones Ferry/Bridgeport	>60.0 E 1.0	31.9 C 0.79
Hall/Sattler/Ross	>60.0 F >1.0	27.4 C 0.85
Hall/Durham	>60.0 F >1.0	45.6 D 0.86
ORE 99W/Walnut	40.6 D 0.93	52.0 D 0.87
ORE 99W/Garrett	3.4 A 0.51	3.4 A 0.51
ORE 99W/Park	22.8 C 0.84	18.6 B 0.76
ORE 99W/Tigard Marketplace	18.5 B 0.57	18.5 B 0.57
ORE 99W/McDonald/Gaarde	>60.0 F >1.0	67.1 E 1.0
ORE 99W/Canterbury	16.9 B 0.83	15.4 B 0.76
ORE 99W/Bull Mountain	30.1 C 0.95	27.0 C 0.89
ORE 99W/Beef Bend	67.2 E >1.0	54.8 D 0.88
ORE 99W/Durham	>60.0 E >1.0	40.2 D 0.82
Tiedeman/Walnut	>60.0 F >1.0	24.0 C 0.90
Murray/Old Scholls Ferry	79.4 E >1.0	51.1 D 0.92
Barrows (W)/Scholls Ferry	8.7 B 0.73	9.1 B 0.70

Intersection	2015 Base	2015 Mitigated
Signalized Intersections (future)	*Delay LOS V/C*	
Beef Bend/Scholls Ferry	>60.0 F >1.0	40.2 D 0.96
Unsignalized Intersections		
Greenburg/Oak	A/C	A/C
Burnham/Main	A/C	A/E
97th Ave/McDonald	A/E	A/D
135th/Walnut		

Alternatives

To address these deficiencies, a series of alternatives and strategies were considered by the TSP Task Force. The range of strategies includes:

- **Do nothing:** This results in severe impacts to motor vehicle and transit circulation in Tigard with delays which would not be tolerable.

- **Assume that alternative modes can serve excess demand.** The TSP analysis assumed that alternative modes would be developed to their optimal levels. The order of magnitude of trips to be served in 2015 goes well beyond the capacity of the alternative mode systems by themselves, even at their optimal levels. Forecasted vehicle trips in the PM peak hour range from 40,000 to 50,000 in the future – transit would serve only about 3,000 to 5,000 person trips in Tigard.

- **Build all the road capacity necessary to achieve level of service D conditions at intersections.** This strategy would have significant impact on right-way-way for roads. Larger roads would be the result; that is contrary to the more livable, pedestrian friendly outcome expressed by the TSP Task Force.

- **Pragmatically add capacity to all modes, developing a balanced system.** Outline the long term configuration of streets to allow development to best accommodate future needs**.** The TSP Task Force chose to pursue this strategy. It involves significant system improvements, but is the only alternative that balances performance between modes, consistent with regional policy**.**

With the chosen strategy, there were numerous alternatives explored in developing the balanced system. Street improvements are required throughout Tigard in the next twenty years. Working with the top three priorities of the TSP Task Force, alternatives were considered in each of the following:

1. Regional Circulation Enhancements
2. Connectivity/Circulation Improvements within Tigard
3. Traffic Operational Improvements

Regional Circulation Enhancements

Through the travel forecasting efforts, tests were conducted of a variety of motor vehicle improvements. Within Tigard, the most significant changes in future traffic volume resulted from

improvements to regional highways. Because Tigard is located at the junction of two major urban freeways and is bifurcated by ORE 99W, its arterial street system (which is very limited – not a traditional grid) is impacted by the performance of these regional facilities. Today, incidents on I-5 or ORE 217 send traffic cascading through Tigard, snarling local circulation that has few options. Future solutions could focus on regional highways alone – however, this TSP takes an integrated approach to regional, city circulation and traffic operational improvements. Therefore, while the following regional improvements are substantial – they are part of an overall package of improvements needed to balance future circulation needs. The following four sections outline problems identified in the future forecasts and possible solutions for ORE 217, traffic between ORE 99W and I-5, I-5 and ORE 99W.

1. ORE 217 is Overcapacity. Many prior adopted plans have identified the need for additional capacity on ORE 217 (RTP, Western Bypass Study, Washington County Transportation Plan, Beaverton TSP). Recent studies by ODOT[18] indicate additional corridor capacity can accommodate 20 year demand and that various alternatives are possible (ranging from general purpose lanes to high occupancy vehicle lanes to high occupancy toll lanes to a transitway to off-system improvements). Further analysis in the ORE 217 Corridor Study will lead to a preferred alternative for this corridor. Tigard is substantially impacted by the lack of additional capacity on ORE 217 (routes such as Scholls Ferry Road, Hall Boulevard, ORE 99W, Greenburg Road and Walnut Street all will operate over capacity without ORE 217 improvements). An improvement to ORE 217 is critical to maintaining adequate circulation capacity in Tigard. However, the improvements to ORE 217 are of regional significance and the City should work together with other agencies to define the most appropriate corridor enhancement. ***For this TSP, a space holder project of widening ORE 217 by one lane each way is identified (similar to other approved plans noted above) until the Corridor Study gains consensus on the preferred ORE 217 alternative.***

2. Tigard continues to serve growing cut-through traffic on ORE 99W. Future forecasts for ORE 99W show it is well over capacity in future demand. A significant share of traffic is regional in nature and cuts through Tigard. This demand (Sherwood/Yamhill County/Oregon Coast) has limited other alternative routes. Prior studies in the Washington County Transportation Plan called for a Western Bypass connecting I-5 with ORE 99W and further to the north toward Hillsboro. This connection has been studied in the Western Bypass Corridor Study conducted by ODOT in the early 1990's. There are few alternatives to serving this regional traffic. Therefore tests were conducted of two regional options to determine their impact on Tigard streets. The first is a connection between I-5 and ORE 99W. ODOT continues to evaluate this connection. While helpful in reducing cut through traffic on ORE 99W in Tigard (a few hundred vehicles in the peak hour), its benefit to Tigard traffic operation is minimal. ORE 99W still fails with or without the I-5/ORE 99W connector. The greatest benefits of the I-5/ORE 99W connector are east-west streets in Tualatin. Even Durham Road benefits from the I-5/ORE 99W connector***. While by itself the benefits are not large in Tigard, the I-5/ORE 99W contributes to mitigating ORE 99W and should be supported by Tigard as a helpful regional improvement.***

The northern portion of the Western Bypass was also investigated as to its benefits to Tigard circulation. In testing this connection with the regional model, there was little if any benefit of

[18] ORE 217 Corridor Study Initial Improvement Concepts Draft, ODOT, February 2000.

northerly connections north of Scholls Ferry Road. While traffic is attracted to the new route, it creates significant impact on streets such as Scholls Ferry Road (creates balanced peak flows rather than directional flows resulting in capacity failures). Additionally, routes such as ORE 99W which are in the most need of benefits from such a facility sees less than 100 vehicles per hour benefit. ORE 99W gains as much mitigation benefit from an enhanced Beef Bend/Elsner Road arterial as it does from any "Western Bypass". ***Therefore, this analysis finds little or no operational benefit to Tigard from a Western Bypass.***

3. I-5 fails south of ORE 217 impacting Tigard streets at peak times. The modified 2015 travel forecasts show congestion on I-5 south from ORE 217 to I-205 and Wilsonville. The lack of capacity on I-5 results in diversion onto Tigard surface streets (and as with ORE 217, the limited circulation network breaks down). Without I-5 improvements, it is unlikely that the southeastern portion of Tigard will be without extensive congestion in peak periods. Unlike improvements to ORE 217 (which have been adopted in various plans) there is little regional recognition of the I-5 south corridor deficiencies and need for improvements. No amount of ramp metering or freeway management can avoid this deficiency. Based upon the modified 2015 forecasts, the addition of one lane each direction (including ramp braids between ORE 217 and Carman Drive, retaining auxiliary lanes from Carman Drive to Lake Oswego/Durham exit) is necessary to reduce impact of several hundred peak hour vehicles on Tigard surface streets. As with ORE 217, this improvement is of regional significance and Tigard should work with affected agencies in determining the most appropriate corridor improvements. There is a strong relationship between the ORE 217 needs and I-5 needs and any corridor improvement to one corridor should consider the other**. For this TSP, a space holder of additional person carrying capacity on I-5 south of ORE 217 to I-205 is identified until appropriate corridor studies can determine the preferred solution for both I-5 and ORE 217.**

4. ORE 99W fails in the future without improvement. Of all the regional transportation issues in Tigard, ORE 99W is probably the closest to a "rubik's cube". Tigard depends heavily on ORE 99W as its primary arterial. There are no parallel routes to ORE 99W and its diagonal alignment and the physical features of Tigard make using ORE 99W essential for also any trip in Tigard. ORE 99W's statewide status and linkage to Yamhill County and the Oregon Coast have similar issues – the only route servicing northeast-southwest travel. The future demand for this corridor is well beyond its five lane capacity without system-wide improvements. Ten various alternatives to improving ORE 99W were investigated, ranging from the no improvement to radical capacity improvements. Table 8-5 summarizes the wide range of alternatives. Unfortunately, no one improvement results in desirable (better than level of service F) operation. The most significant finding was that no matter whether ORE 99W was widened southwest of Greenburg Road, the end result was failure. Added capacity on ORE 99W (tested by modeling seven lanes) resulted in significantly higher turning movements on/off ORE 99W and large through movements on ORE 99W. The end result was that not only would you have to widen to seven lanes but at nearly every intersection additional turning lanes were needed (double lefts, right turn) creating nearly a 10 lane cross section at intersection. And even after that the end result was level of service F conditions. Therefore the recommended approach combines several elements to produce a minimally acceptable operating condition. ***The TSP recommends: 1) widening ORE 99W to seven lanes between I-5 and Greenburg Road; 2) retaining the five lane cross section southwest of Greenburg Road; 3) extensive intersection improvements – turning lanes; 4) access management; 5) improvements to ORE 217 and I-5 noted above; 6) off-system***

improvements such as freeway improvements and arterials such as Walnut extension; and 7) consideration of a western/Yamhill County commuter rail corridor.

Table 8-5
ORE 99W Alternatives Evaluation

Alternative	Key Elements	Findings
Retain ORE 99W as 5 lanes	No improvement	Level of Service F operation in 20 years; extensive congestion beyond existing levels
Widen to 7 lanes I-5 to Greenburg **Retain 5 lanes west of Greenburg**	Widening of ORE 99W in key segment between I-5 and ORE 217	Resolves many of the Tigard Triangle operational problems, requires off-system improvements and access management to work at Level of Service E, significant business impact
Widen ORE 99W to seven lanes	Complete corridor widening Requires extensive intersection improvement (multi-turn lane)	Attracts significant traffic from arterials that can be made to work in future – added ORE 99W traffic is nearly unmitigatable at intersections due to heavy through traffic and conflicts with turning vehicles – results in LOS F conditions after widening, substantial business impact
Retain 5 lane ORE 99W, use other regional routes to mitigate	Widening of ORE 217, I-5 and a new ORE 99W to I-5 Connector	Helps ORE 99W significantly (several hundred vph) but segment between I-5 and Greenburg (Tigard Triangle area) remains at LOS F
Retain 5 lane ORE 99W, widen Hall/McDonald/Bonita/Durham	Other Tigard arterials widened to five lanes to improve other arterials	Does not resolve Tigard Triangle area, major residential impacts of multiple arterial widening, other arterials can get by with three lanes
Build a viaduct above ORE 99W from I-5 to southwest of Durham	Provide ramps only at the ends and at ORE 217	Pulls substantial (30 to 60%) portion of traffic off ORE 99W, a few local intersections still operate poorly, very expensive (~$300,000,000)
Implement Access Management	Closes driveways, limits access points to 1,000 feet	Improves capacity 25-35%, substantial business impact, difficult to implement – could take 50 years to fully implement – minor capacity gain with phased or limited implementation – level of service is still a problem
Build a bypass around ORE 99W in Tigard	New roadway near Beef Bend/Elsner linking to Scholls Ferry Road and heading further north	Does not substantially reduce traffic on ORE 99W, LOS F remains
Fronting Roadways along ORE 99W	Build entirely new fronting roadway either adjacent to ORE 99W or behind fronting land uses	Substantial land use impact, traffic benefit is marginal on the whole but good benefits in selected locations, LOS still F, could consider better connectivity between I-5 and ORE 217
Commuter Rail to the west serving Sherwood, Newberg,	Would require large park and ride lots, could consider bus alternative	May be useful in twenty years to reduce ORE 99W potential demand by 400 to

Alternative	Key Elements	Findings
Yamhill County, Spirit Mountain and the coast	however, congestion on ORE 99W would result in slower operation	800 vehicles per hour – by itself not enough to mitigate problems on ORE 99W but helps reduce through traffic

Connectivity/Circulation Improvements in Tigard

Several alternative connections were explored throughout Tigard to address future deficiencies. While improvements were considered in many locations, there were four primary areas where future problems are significant:

- Washington Square Area
- Tigard Triangle Area
- Western Tigard capacacity
- East-West Circulation Capacity
    1. Durham Road area
    2. North of Durham

Washington Square Area. The Washington Square Regional Center Plan has recently been completed and will be adopted by City Council. It outlines many of the transportation alternatives for this area. There are three significant improvements that have been identified for the regional center area:

- **Overcrossings of ORE 217.** To relieve the over-capacity ORE 217 interchanges near Washington Square, two new overcrossings are identified for the next 20 years. The first is between Greenburg and Scholls Ferry Road, linking Washington Square Road over the top of ORE 217 connecting Locust with Nimbus Avenue. This overcrossing is highly effective in reducing traffic at ORE 217/Scholls Ferry Road (about 10,000 to 20,000 vehicles per day). The linkage to Nimbus is critical in mitigating problems at the Scholls Ferry interchange. ODOT has evaluated this overcrossing for its potential to serve drop-in ramps to any high occupancy toll lane scenario on ORE 217. The second overcrossing is an extension of the Washington Square Road near Scholls Ferry, over ORE 217 to access Cascade Avenue (potentially Nimbus Avenue also). This linkage may become necessary with the widening of ORE 217 and the close proximity of the Scholls Ferry/Cascade intersection to ORE 217. Widening of ORE 217 may require the closure of the Scholls Ferry/Cascade intersection and this new overcrossing would be a replacement to that lost access. The southern overcrossing should be viewed as the higher priority of the two overcrossings since it carries more traffic (the southerly crossing has 5,000 to 10,000 vehicles per day).

- **Scholls Ferry Road widened to seven lanes**. Future traffic in the regional center area results in level of service F conditions without additional lanes on Scholls Ferry Road. Even with new overcrossings, Scholls Ferry fails in 20

years. Because widening Scholls Ferry Road is a complex right-of-way task, the overcrossings of ORE 217 should be implemented first before full widening of Scholls Ferry Road. The timing of ORE 217 improvements will also affect the timing of the seven lane improvement. Based upon capacity analysis for the future years, the seven lane widening should extend to Barrows Road/Davies Road. Right of way for seven lanes should be preserved in this corridor to Murray Boulevard to address potential future Town Center and other future growth potential needs possibly within or outside the 20 year planning horizon. An alternative to be considered in this projects development would be a viaduct from ORE 217 west over the railroad tracks forming an expressway for approximately a half mile from Hall to west of Nimbus.

- **Greenburg Road widening**. The eastern face of Washington Square will require reevaluation of access to the center. Widening of Greenburg Road to two lanes each way north of Locust past the cemetery will require extensive right-of-way acquisition. The four lanes are needed to avoid level of service F conditions on Greenburg at Locust and Hall. The segment adjacent to the cemetery could be four lanes with no access and no left turn lanes to minimize right of way taking.

- **Other roadway connections**. Three other roadway connections were considered in the Washington Square area. Two were recommended in the Regional Center Plan. While these roadway connections have some benefit to capacity in the area, but these linkages are significant in improving circulation in the Washington Square area. The first connection is the extension of Nimbus Avenue south to Greenburg Road. This linkage attracts 9,000 to 15,000 vehicles per day (in the future with ramp metering). It is very helpful in reducing short trips on ORE 217 and minimizing impacts to streets such as 121st Avenue. Wetland and railroad constraints require further investigation as to the feasibility of this linkage. The second was a collector roadway linking Locust Street to Oak Street east of Greenburg Road. This linkage serves between 5,000 and 10,000 vehicles per day, reducing the burden of local trips on Greenburg Road. Both of these connections were recommended in the Washington Square Regional Center Plan. The third connection studied was a link from Pfaffle Street with Oak Street and Lincoln Street, paralleling ORE 217. This linkage was rejected in the Washington Square Regional Center Plan study. While helpful in relieving Hall Boulevard, the impacts were found to be greater than the benefits in that study. The outcome of not selecting this connector is that Hall Boulevard must have right-of-way set aside for a five lane roadway.

Tigard Triangle Area. This subarea is also subject of a recently adopted plan. The basic package of street improvements needed to mitigate level of service F conditions in this area include:

- ORE 99W seven lanes
- Dartmouth Street five lanes
- 72nd Avenue five lanes
- Atlanta Street extended from Haines Street to 72nd Avenue
- Backage roads to ORE 99W (providing access to business but not directly on ORE 99W)

- Reconstructed ORE 217/72nd Avenue interchange utilizing 68th Parkway for northbound ORE 217 access (closing the existing substandard northbound 72nd ramps).
- A Hunziker to Hamption overcrossing of ORE 217

Other options considered in this sub area included a Dartmouth to Hunziker overcrossing of ORE 217, an extension of Atlanta Street to Dartmouth Street and five lanes on ORE 99W. The following summarizes the findings of these options:

Dartmouth to Hunziker ORE 217 Overcrossing	Attracts less than 5,000 vehicles per day by itself; extend Walnut to link up with the overcrossing of ORE 217 and the volume increase to 8,000 per day. Implement complete ramp metering in the Tigard Triangle area (on ORE 217 and I-5) and the volume increases to 13,000 vehicles per day. Most of the traffic benefits of the overcrossing are produced with the Hunziker to Hampton overcrossing and the Dartmouth to Hunziker overcrossing has limited additional benefit. Unfortunately, ORE 99W still requires mitigation with or without overcrossing; access to ORE 217 would not be allowed by ODOT due to substandard spacing resulting in unsafe operation at large expense. One option where this overcrossing may be desirable in the future would be where ramp metering is fully operational and improvements to ORE 217 include a High Occupancy Toll (HOT) or High Occupancy Vehicle (HOV) lane alternative where direct connections to ORE 99W are desired. The Dartmouth to Hunziker overcrossing could provide access to the Tigard Triangle and ORE 99W area via drop in ramps. Therefore, a potential alignment should be preserved for future consideration (where the alignment would go through parking lots). However, the overcrossing is not part of the street improvement plan in the TSP.
Atlanta Extension to Dartmouth	While the Atlanta extension to 72nd is 10,000 to 15,000 vehicles per day the segment to the south connecting to Dartmouth is well below that level. Recent development has blocked an optimal alignment. Backage roads will be more effective in this setting. The TSP includes the Atlanta extension to 72nd and backage roads with redevelopment.
Five lane ORE 99W	Level of service F conditions result in Tigard Triangle without 7 lanes. This option would limit the potential of the Tigard Triangle to serve the projected land use in the future. There were no subarea alternatives that precluded the need for 7 lanes between I-5 and 217.

Western Tigard Capacity. Future growth in western Tigard results in the need for improved north-south and east-west capacity. Today most of the western Tigard land is vacant or under utilized. While Beef Bend Road serves this area adequately today, future land use growth will generate demand for over 10,000 vehicles per day. For Beef Bend to operate satisfactory in the future with two to three lanes, access must be limited to maximize the operating capacity of the only north/south and east/west linkage in the western end of Tigard. With 1,000 foot spacing the capacity of Beef Bend Road can be preserved at 1,200 to 1,500 vehicles per hour per lane. With current access spacing the capacity of Beef Bend Road would drop to 700 to 900 vehicles per hour per lane. Because of its rural stature today and under developed frontage, there is potential to avoid similar mistakes made on other arterial routes (such as ORE 99W or Greenburg Road) where frequent driveways rob the potential capacity of the roadway. Access from local streets not Beef Bend, consolidation of driveways and the use of medians should all be implemented on Beef Bend. Without this treatment, Bull Mountain

Road will carry the additional load and the lost capacity from frequent driveways will virtually require another new roadway to service the same traffic. Similar consideration should be given to 150th Avenue. Spacing of access points every 600 feet should be considered on 150th.

East-west Circulation Capacity. Future demand for east-west travel on Tigard's east side will result in level of service F conditions. Two options were evaluated to address this future deficiency. First widening Bonita and McDonald to five lanes was considered. Because Bonita does not connect to the I-5 freeway ramps (Carman does), there is limited benefit achieve by five laning the McDonald-Bonita corridor. Both Carman and Durham remain at LOS F. A second option was considered by widening Carman Drive at I-5 to five lanes and connecting it directly to Durham Road. This option eliminates the level of service F conditions and provided safer operation for the majority of vehicular traffic. The heavy traffic on Durham Road is prevalent from Carman Drive to Hall Boulevard. Traffic on Durham drops sharply west of Hall and can be handled by a three lane cross section. Right-of-way in the Durham corridor should be preserved for a five lane roadway, even though this TSP calls for three lanes west of Hall Boulevard. The impacts of the Carman to Durham option are less than the Bonita/McDonald option for the following reasons: 1) level of service is adequate with Carman/Durham and not with Bonita/McDonald resulting in unsafe operating conditions; 2) Carman/Durham accesses I-5; 3) even with three lanes Durham is carrying high traffic volume east of Hall (15,000 to 20,000 vehicle per day). The impacts of street improvements to Carman/Durham can be minimized through design (medians, landscaping). Other alternatives to serve future east-west demand are precluded due to the railroad , wetlands, river and being too far north or south to serve the projected demand.

Traffic Operational Improvements

A series of intersection improvements were identified which primarily add turning movement capacity. These roadway improvements typically consist of left and right turn lanes and/or traffic signals. Nine of the study intersections require significant improvements. Most of these intersection improvements are complementary to the regional improvements and connectivity enhancement noted above.

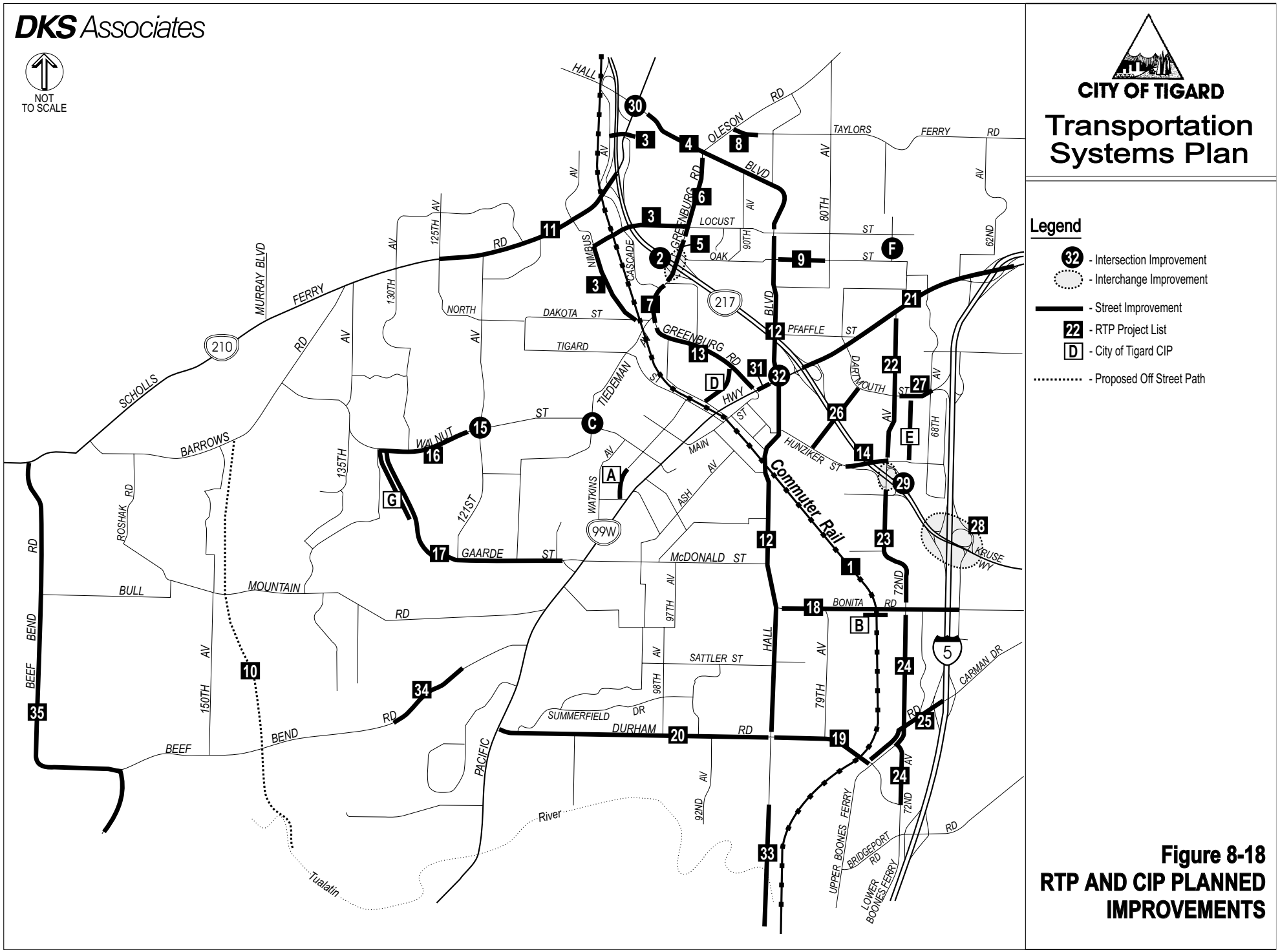

DKS Associates
NOT TO SCALE
CITY OF TIGARD
Transportation Systems Plan
Legend
32 - Intersection Improvement
- Interchange Improvement
- Street Improvement
22 - RTP Project List
D - City of Tigard CIP
- Proposed Off Street Path
HALL
OLESON RD
TAYLORS FERRY RD
BLVD
GREENBURG RD
LOCUST ST
OAK ST
80TH AV
62ND AV
125TH AV
MURRAY BLVD
FERRY RD
NIMBUS
CASCADE
90TH AV
NORTH DAKOTA ST
TIGARD
130TH AV
217
PFAFFLE ST
DARTMOUTH ST
68TH AV
SCHOLLS FERRY RD
210
TIEDEMAN AV
HWY 99W
MAIN ST
HUNZIKER ST
WALNUT ST
BARROWS RD
135TH AV
ROSHAK RD
121ST AV
WATKINS AV
ASH AV
Commuter Rail
KRUSE WY
GAARDE ST
McDONALD ST
72ND AV
BULL MOUNTAIN RD
97TH AV
BONITA RD
SATTLER ST
HALL AV
CARMAN DR
BEEF BEND RD
150TH AV
98TH AV
79TH AV
SUMMERFIELD DR
DURHAM RD
PACIFIC
92ND AV
River
Tualatin
UPPER BOONES FERRY RD
BRIDGEPORT RD
LOWER BOONES FERRY RD
72ND AV
Figure 8-18
RTP AND CIP PLANNED IMPROVEMENTS

Table 8-6
Proposed 20 Year Metro and Planned CIP Projects

Table 8-6				
Project No.	**Project Name (Facility)**	**Project Location**	**Project Description**	**Estimated Project Cost**
Regional Transportation Plan, August 2000				
1	Beaverton-Wilsonville Commuter Rail	Wilsonville to Beaverton	Constructs peak-hour service only with 30-minute frequency	$75,000,000
2	Highway 217 Ramp Improvements - Greenburg	Greenburg Road and Highway 217	Widen Greenburg off-ramps; install ramp meter to Highway 217	$ 12,000,000
3	Highway 217 Overcrossings & Connections	Washington Square Area	Cascade Plaza to Washington Square OC Locust to Nimbus OC Nimbus to Greenburg connector	$25,000,000 $15,000,000 $15,000,000
4	Hall Boulevard Improvements	Scholls to Locust	Widen to 5 lanes with boulevard design	$ 4,700,000
5	Greenburg Road Improvements	WashingtonSquare Road to Shady Lane	Widen to 5 lanes with boulevard design; NB Highway 217 off-ramp improvement	$ 2,500,000
6	Greenburg Road Improvements, North	Hall Boulevard to Washington Square Road	Widen to five lanes with bikeways and sidewalks	$ 2,500,000
7	Greenburg Road Improvements, South	Shady Lane to N. Dakota	Widen to five lanes with bikeways and sidewalks	$ 2,000,000
8	Taylors Ferry Road Extension	Washington Drive to Oleson Road	Three lane extension with bikeway and sidewalks	$ 1,900,000
9	Oak Street Improvements	Hall Boulevard to 80th Avenue	Signal improvement, bikeway and sidewalks	$ 800,000
10	Powerline Trail Corridor	Farmington Road to Lower Tualatin Greenway	Plan, design and construct multi-use path	n/a
11	Scholls Ferry Road Improvements	Highway 217 to 125th Avenue	Widen to seven lanes with access management	$ 15,760,000
12	Hall Boulevard Improvements	Locust to Durham Road	Improve Hall Boulevard to 5 lanes	$ 4,700,000
13	Greenburg Road Improvements	Tiedeman Road to 99W	Widen to 5 lanes	$ 4,800,000
14	Highway 217 Overcrossing - Tigard	Hunziker Street to 72nd at Hampton	Construct new two-lane crossing of Highway 217	$ 4,000,000
15	Walnut Street Improvements, Phase 1	at 121st Avenue	Install traffic signal at 121st Avenue	$ 1,750,000
16	Walnut Street Improvements, Phase 3	Gaarde Street to 121st Avenue	Widen to three lanes with bikeways and sidewalks	$ 5,720,000
17	Gaarde Street Improvements	110th Avenue to Walnut Street	Widen to three lanes with bikeways and sidewalks	$ 4,000,000
18	Bonita Road Improvements	Hall Boulevard to Bangy Road	Widen to four lanes	$ 8,000,000
19	Durham Road Improvements	Upper Boones Ferry Road to Hall Boulevard	Widen to five lanes	$ 3,500,000

Table 8-6				
Project No.	**Project Name (Facility)**	**Project Location**	**Project Description**	**Estimated Project Cost**
20	Durham Road Improvements	Hall Boulevard to 99W	Widen to two lanes westbound, 1 lane eastbound, turn lane, bikeways and sidewalks	$ 5,000,000
21	99W Improvements	I-5 to Highway 217	Widen to seven lanes	$ 25,000,000
22	72nd Avenue Improvements	99W to Hunziker Road	Widen to five lanes	$ 3,000,000
23	72nd Avenue Improvements	Hunziker Road to Bonita Road	Widen to five lanes	$ 5,000,000
24	72nd Avenue Improvements	Bonita Road to Durham Road	Widen to five lanes with bikeways and sidewalks	$ 5,000,000
25	Upper Boones Ferry Road	I-5 to Durham Road	Widen to five lanes	$ 3,000,000
26	Dartmouth Street Extension	Dartmouth Road to Hunziker Road	Three lane extension; new Highway 217 overcrossing	$ 28,000,000
27	Dartmouth Street Improvements	72nd Avenue to 68th Avenue	Widen to four lanes with turn lanes	$ 500,000
28	I-5/ORE 217 Improvements	I-5/ORE 217 Interchange	Interchange Modernization Phases 2 & 3	$ 54,000,000
29	Highway 217/72nd Avenue Interchange Improvements	Highway 217 and 72nd Avenue	Complete interchange reconstruction with additional ramps and overcrossings	$ 15,000,000
30	Scholls Ferry Road Intersection Improvement	At Hall Boulevard	Add SB right turn lane from SB Hall Boulevard	$ 500,000
31	Highway 99W Bikeway	Hall Boulevard to Greenburg Road	Retrofit for bike lanes	$ 500,000
32	Highway 99W/Hall Boulevard Intersection Improvements	99W/Hall Boulevard	Add turn signals and modify signal	$ 3,700,000
33	Hall Boulevard Extension	Extension from Durham to Tualatin Road	Extend Hall Boulevard to connect across the Tualatin River	$ 25,000,000
34	Beef Bend Road	King Arthur to 131st	Widen to three lanes	$5,000,000
35	Beef Bend/Elsner	ORE 99W to Scholls Ferry	Widen to three lanes	$24,000,000
	Subtotal		**RTP Group**	**$410,830,000**
Tigard CIP Projects (FY 1999-2000 CIP, Includes Projects through 2001-2002)				
A	Grant Avenue Pedestrian Improvements	Park Street to School Street to Charles F. Tigard Elementary School	Provide a pedestrian path along Grant Avenue connecting the existing walkway to Charles F. Tigard Elementary School	$ 47,000

Table 8-6				
Project No.	**Project Name (Facility)**	**Project Location**	**Project Description**	**Estimated Project Cost**
B	Bonita Road Improvements (completed)	Railroad Tracks to Fanno Creek	Underground utilities, reconstruction of railroad crossings, street widening	$ 386,000
C	Walnut/Tiedeman Realignment (completed)	Walnut Street/Tiedeman Avenue	Intersection realignment and signalization	$1,300,000
D	Lincoln Street Improvements	Between Greenburg Road and Commercial Street	Construct half-street improvements, including sidewalks, curbs and streetlights	$ 190,000
E	69th Avenue LID	Between Hampton Street and Dartmouth Street, also includes Beveland Street from 68th Avenue to 70th Avenue	Construct 69th Avenue to ultimate section in compliance with Tigard Triangle Design Standards	$ 1,600,000
F	Mapleleaf/71st Avenue	from 72nd Avenue to Oak Street	Widens existing pavement on 71st Avenue and Mapleleaf Street to the standard width of a local street	$ 650,000
G	Gaarde Street Extension (completed)	Quail Hollow to Walnut	Construct street to ultimate section (Cost is for design & ROW only)	$ 50,000
	Subtotal		**City CIP Group**	**$ 4,223,000**
	Total			**$ 415,053,000**

Recommended Improvements

The improvements needed to mitigate modified 2015 future conditions combine both those identified in prior plans (Figure 8-18 and Table 8-6) and those determined as the outcome of the TSP transportation analysis. The improvements shown in Figure 8-18 are part of the updated RTP listing for the Tigard area which is in process of approval (planned summer 2000). Also shown on Table 8-6 is a listing of the City of Tigard Capital Improvement Program projects through 2002. Of all the improvements identified in the TSP analysis, only three projects were not included in the TSP improvements. Each of these three improvements may be necessary within or after the 20 year time frame of the TSP. The forecasts for the TSP did not indicate they were necessary with the modified 2015 forecast. Right-of-way should be preserved for each of these projects for future consideration.

- Bonita Road widening to four lanes from Hall to Bangy (preserve right-of-way)
- Durham Road widening west of Hall Boulevard (preserve right-of-way)
- Dartmouth to Hunziker overcrossing of ORE 217 (retain an alignment for future ORE 217 HOT/HOV options)

Of all the TSP recommended improvements most projects have been discussed for several years. There is one significant project (the extension of Walnut) that is different than prior plans. Circulation and capacity deficiencies along ORE 99W and Tigard Triangle required more than spot intersection improvements or roadway widening to mitigate future growth impacts. The ability to circulate in Tigard from northwest to east is severely limited except for ORE 99W. There are few options to accommodate additional circulation. One option was to realign Greenburg Road to Johnson Street. Another was to extend Walnut Street west of ORE 99W. The Greenberg Road realignment did little to improve capacity. The Walnut extension helped resolve problems in the ORE 99W area near Hall/Greenburg and in the Tigard Triangle area on ORE 99W. The specific alignment of this improvement would need to be detailed in project development. However, three alignments were initially investigated. First an alignment from ORE 99W/Walnut northeasterly over Fanno Creek to the Ash Street right-of-way running north to intersect with Scoffins/Hunziker. This allowed traffic to proceed on Hunziker east to Tigard Triangle over the recommended overcrossing to 72nd/Hampton. It would also serve as direct access to the proposed commuter rail station area. Other alignment options that should be explored would be connecting to Burnham/Hall and continuing northward to Hunziker to a likely location for the conceptual overcrossing of ORE 217 from Dartmouth (not part of this TSP – more than 20 years in the future). A third alignment would utilize City Hall right-of-way and align similar to the second option with Hunziker. More detailed study of the alignment will be part of the future project development.

A key issue in determining need was the level of service calculation. The 1997 Highway Capacity Methodology for the peak hour was utilized. ODOT and Metro have recently adopted two hour level of service. To approximate this measure, the volume-to-capacity ratios in Table 8-4 can be multiplied by a ratio of the average of the two hour volume divided by the peak hour volume. This ratio ranges from 0.93 to 0.97 at intersections in Tigard in 1999. Very few improvements would change under this assessment of capacity. Nearly all the improvements needed in the peak hour would also be necessary in the two hour.

The recommended TSP motor vehicle improvements are summarized in Table 8-7 and Figure 8-19. Several spot improvements were also identified at various intersection in Tigard and they are summarized in Figure 8-20 and Table 8-8. Prioritization should occur in coordination with the CIP Figure 8-18 Street Improvement Plan process. All improvements on arterials and collectors shall include sidewalks, bike lanes and transit facilities. These improvement lists should be used as a starting point for inclusion in regional funding programs for streets.

Table 8-7
Future Street Improvements
(All Projects include sidewalks, bicycle lanes and transit accommodations as required)

Location	Description	Funding Status*
I-5	Widen to 4 plus auxiliary lanes (each direction) between ORE 217 and I-205/Wilsonville Widen to 4 lanes (each direction) south to Wilsonville	Not Funded Not in any plan
ORE 217	Widen to 3 lanes plus auxiliary lanes (each direction) between US 26 and 72nd Avenue New ORE 217/I-5 interchange between 72nd Avenue and Bangy Road	Not Funded In RTP (as widening or HOV or HOT) Phase I Funded Phase II in RTP
ORE 99W	Widen to 7 lanes (total—both directions) between I-5 and Greenburg Road	In RTP
I-5 to ORE 99W Connector	Connector linking I-5 and ORE 99W (model assumed connector would be located north of Sherwood—specific location to be determined by further study)	In RTP
Overcrossings over ORE 217	5 lane overcrossings linking Washington Square and Cascade Avenue—one north of Scholls Ferry Road, one south of Scholls Ferry Road to Nimbus. The Washington Square Regional Center study also identifies linking Nimbus to Greenburg.	Not Funded (identified in Washington Square Regional Center Study & RTP)
Overcrossing of I-5	Widen Carman Drive interchange overcrossing to six lanes from four (two through lanes each way, side by side left turn lanes).	Not Funded In no Plans
Scholls Ferry Road	Widen to 7 lanes (total—both directions) between ORE 217 and Barrows Road (East). Preserve right-of-way for seven lanes to Murray Boulevard for future corridor needs.	Not Funded (widening to 125th identified in Wa.Co, Beaverton TSP & RTP)
Greenburg Road	Widen to 4 lanes adjacent to cemetary	Not funded In Wa.Co. Plan
Walnut Boulevard	Widen to 3 lanes (total—both directions) between 135th (or where Gaarde connects) to ORE 99W Extend Walnut east of ORE 99W to meet Hall Boulevard and Hunziker Street (3 lanes—total, both directions)	In RTP MSTIP for parts Not Funded In no plans
Gaarde Street	Widen to 3 lanes west of 121st to ORE 99W Use access control and 2 lanes in sensitive areas	In RTP

Location	Description	Funding Status*
Hall Boulevard	Extend south to Tualatin (3 lanes—total, both directions)	In RTP
Durham Road	Widen to 5 lanes (total, both directions) between Hall Boulevard and Upper Boones Ferry Road. Reserve right-of-way to the west for 5 lanes	In RTP
Durham Road/Upper Boones Ferry Road intersection	Realign intersection so that Durham Road continues on continous route to I-5/Carmen interchange—Upper Boones Ferry Road would "tee" into Durham Road/Upper Boones Ferry Road intersection	Not Funded In no plans
72nd Avenue	Widen to 5 lanes (total, both directions) between ORE 99W and south city limit at Upper Boones Ferry Road/Carman Drive/Durham Road	In RTP (could be partially funded by development in Tigard Triangle—ie. LID)
Hunziker/Hampton	Realign Hunziker Road to meet Hampton Road at 72nd Avenue—requires overcrossing over ORE 217—removes existing 72nd Avenue/Hunziker intersection	In RTP
Atlanta Street	Extend Atlanta Street west to meet 72nd Avenue	To be funded with development in Tigard Triangle (i.e. LID)
Dartmouth Street	Widen to five lanes from ORE 99W to I-5	In RTP, To be funded by fronting improvements
68th Avenue	Widen to 3-lanes between Dartmouth/I-5 Ramps and ORE 217 Extend 68th Avenue south to meet ORE 217 providing right-in/right-out only access to 68th Avenue from ORE 217, replacing the NB ramps to 72nd at ORE 217	Not Funded (could be partially funded by development in Tigard Triangle—ie. LID)
Scoffins/Hunziker/Hall intersection	Realign Scoffins to meet Hunziker at Hall	Not Funded
Hall Boulevard	Widen to 5 lanes between Washington Green and ORE 99W	In RTP
Beef Bend Road	Access Control should be implemented to preserve capacity with 2 lanes (with intersection turn lanes). Minimum 1,000 foot spacing should be used between any driveway(s) and/or public street(s) Widen from King Aruther to 131st to 3-lanes Widen Beef Bend/Elsner Road to 3-lanes from ORE 99W to Scholls Ferry Road	Not Funded Implemented with adjacent development In RTP MSTIP In RTP MSTIP

* - Refers to inclusion in prior plans such as Regional Transportation Plan (RTP), Major Streets Transportation Improvement Program (MSTIP), Washington County Transportation Plan, Beaverton TSP or other subarea plan. The RTP anticipates funding for projects within the plan in a 20 year horizon.

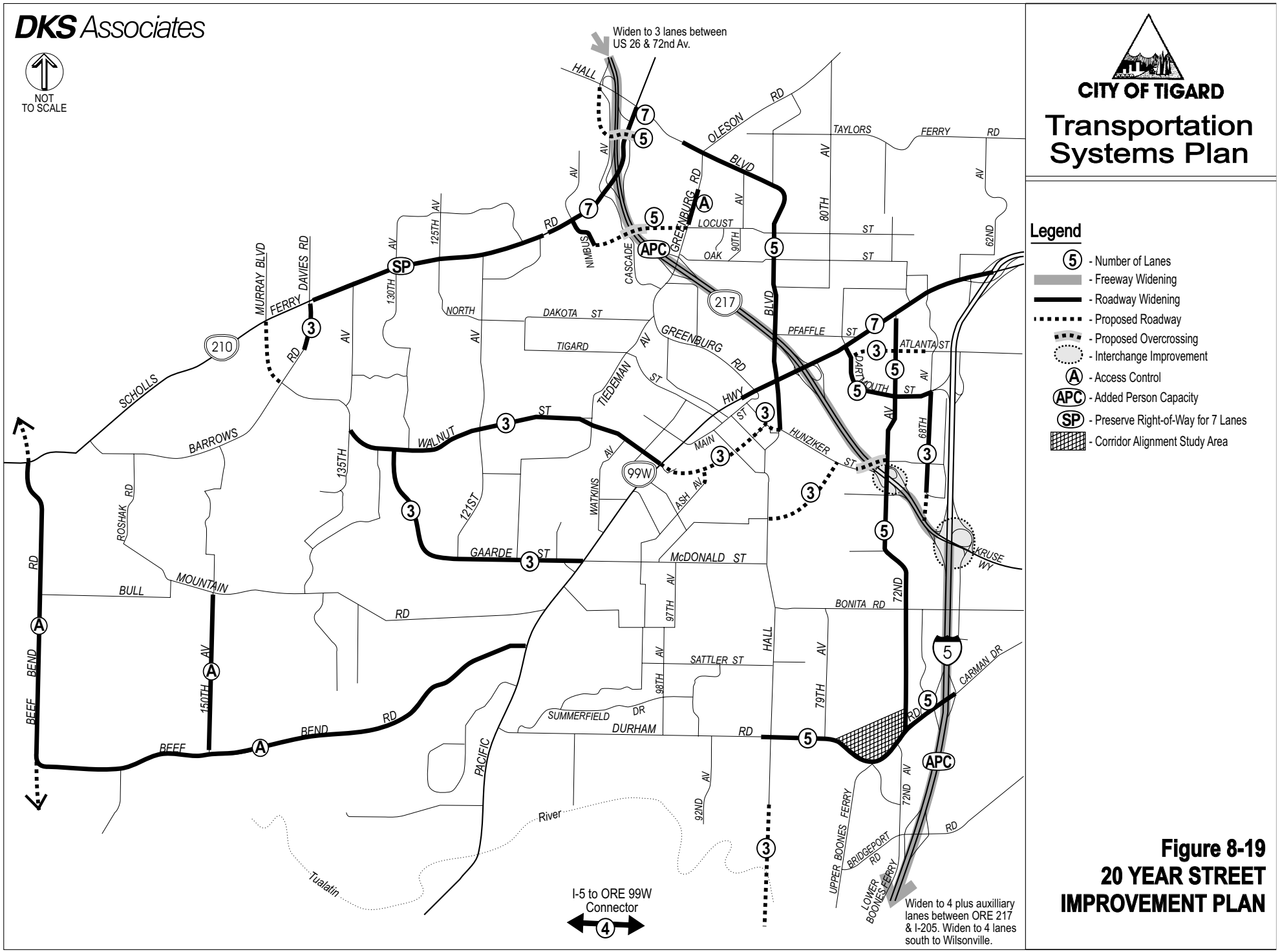


Figure 8-19
20 YEAR STREET IMPROVEMENT PLAN

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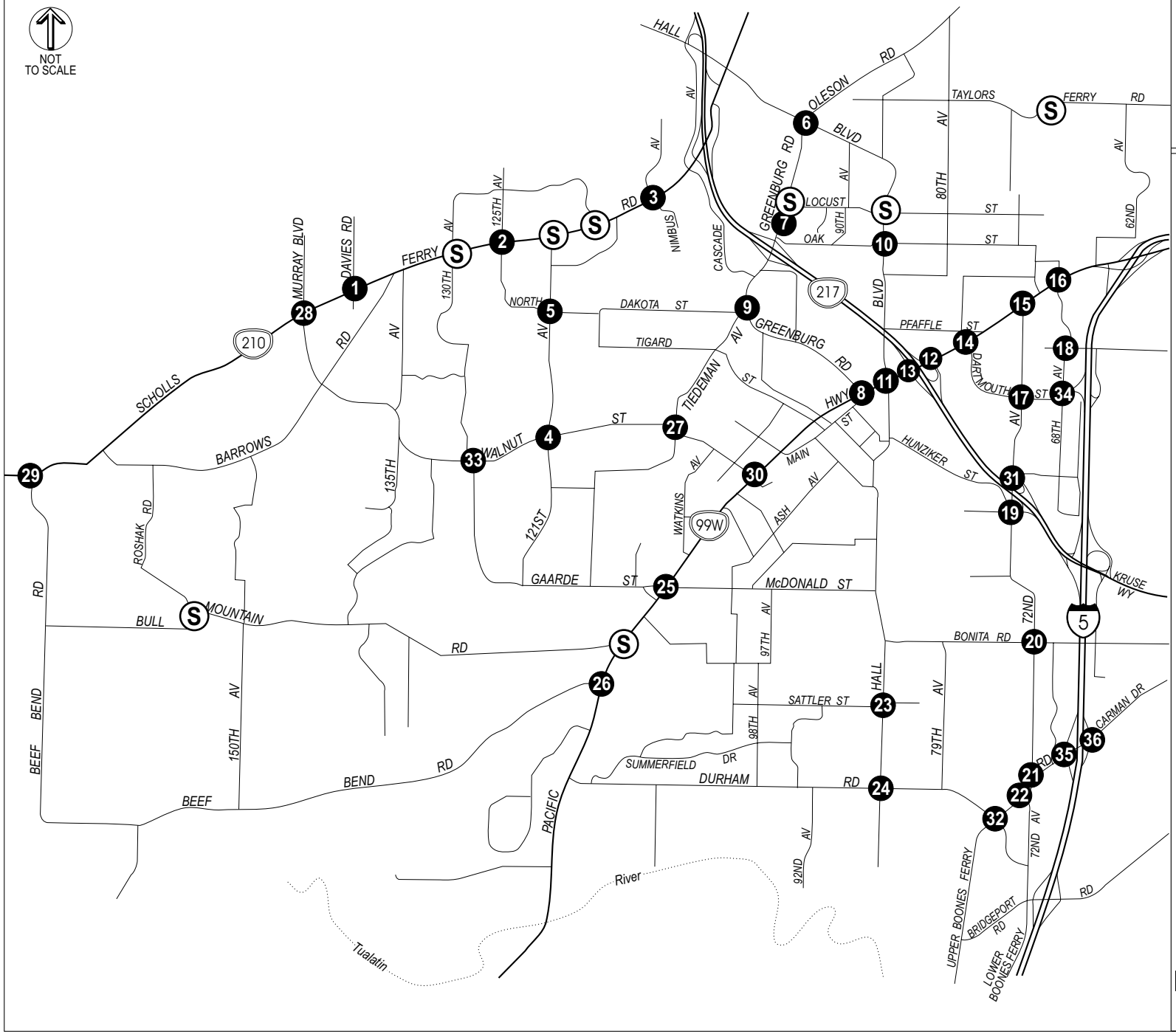

CITY OF TIGARD

Transportation Systems Plan

Legend

00 - Intersection Improvement Location/Number

S - SPIS Safety Improvement Location

Note - Safety Improvements would also be done at same time intersection improvements are undertaken.

Figure 8-20
INTERSECTION IMPROVEMENT LOCATIONS

Table 8-8
City of Tigard Future Intersection Improvements

Table 8-8: Future Intersection Improvements		
No.	**Intersection**	**Description**
1	Davies/Scholls Ferry Road	• Traffic signal • Northbound right turn lane • Realign to meet Barrows Road, close Barrow to local traffic
2	North Dakota/125th/Scholls Ferry Road	• Southbound right turn lane • Retain westbound right turn lane when 3rd lane added on Scholls Ferry Road • Change from protected left turn phasing to permitted phasing north/south
3	Nimbus/Scholls Ferry Road	• Retain eastbound right turn lane when 3rd lane added on Scholls Ferry Road • Retain westbound right turn lane when 3rd lane added on Scholls Ferry Road • Southbound right turn lane • Reconfigure northbound and southbound lanes to create exclusive left turn lanes • Change from split phasing to protected left turn phasing north/south
4	121st/Walnut	• Traffic signal • Northbound left turn lane • Southbound left turn lane • Eastbound left turn lane • Westbound left turn lane
5	121st/North Dakota	• Traffic signal
6	Greenburg/Oleson/Hall	• 2nd northbound left turn lane • Extend signal cycle length • Assumes Hall widened to 5 lanes
7	Greenburg/Washington Square Road	• Southbound right turn lane • Overlap eastbound right turn • Extend signal cycle length
8	Main/Greenburg/ORE 99W	• Southbound left turn lane • Retain westbound right turn lane when ORE 99W widened to 7 lanes
9	Greenburg/Tiedeman	• Extend signal cycle length • Improved geometry/alignment
10	Hall/Oak	• Extend signal cycle length • Assumes Hall widened to 5 lanes
11	Hall/ORE 99W	• Southbound right turn lane • Northbound left turn lane • Westbound right turn overlap • Retain westbound right turn lane when ORE 99W widened to 7 lanes
12	ORE 217 NB Ramps/ORE 99W	• Retain eastbound right turn lane when ORE 99W widened to

Table 8-8: Future Intersection Improvements

No.	Intersection	Description
		7 lanes • Retain westbound right turn lane when ORE 99W widened to 7 lanes • 2nd northbound left turn lane
13	ORE 217 SB Ramps/ORE 99W	• 2nd southbound right turn lane • Retain eastbound right turn lane when ORE 99W widened to 7 lanes
14	Dartmouth/ORE 99W	• Retain eastbound right turn lane when ORE 99W widened to 7 lanes
15	72nd/ORE 99W	• Southbound right turn lane • Northbound right turn overlap • Change to protected left turn phasing north/south • Retain eastbound right turn lane when ORE 99W widened to 7 lanes
16	68th/ORE 99W	• 2nd westbound left turn lane • Northbound left turn lane • Southbound left turn lane • Change to protected left turn phasing north/south
17	72nd/Dartmouth	• Traffic signal • Assumes 72nd Avenue and Dartmouth widened to 5 lanes
18	68th/Atlanta/Haines	• Traffic signal
19	ORE 217 SB Ramps/72nd	• Assumes 72nd Avenue widened to 5 lanes
20	72nd/Bonita	• Assumes 72nd Avenue widened to 5 lanes
21	72nd/Carmen	• 2nd northbound right turn lane
22	72nd/Upper Boones Ferry Road	• Assumes Durham/Upper Boones Ferry/72nd widened to 5 lanes
23	Hall/Sattler/Ross	• Traffic signal • Northbound left turn lane • Southbound left turn lane
24	Hall/Durham	• 2nd southbound left turn lane • Widen west of intersection to introduce 5-lane section on Durham (include existing westbound right turn lane)
25	ORE 99W/McDonald/Gaarde	• Westbound right turn lane • 2nd Northbound left turn lane
26	ORE 99W/Beef Bend	• Southbound right turn lane (on ORE 99W) • Adjust cycle length
27	Tiedeman/Walnut	• Completed • Southbound left turn lane • Eastbound left turn lane • Westbound left turn lane
28	Murray/Scholls Ferry Road	• 2nd westbound right turn lane

Table 8-8: Future Intersection Improvements		
No.	**Intersection**	**Description**
		• Add additional southbound lane to achieve 2 southbound left turn lanes and two southbound through lanes • Extend signal cycle length • Changes to protected left turn phasing north/south and east/west
29	Beef Bend/Scholls Ferry Road	• Eastbound right turn lane • Northbound left turn lane • Eastbound right turn overlap • Change to protected phasing east/west • Change to split phasing north/south
30	Walnut/ORE 99W	• Retain westbound right turn lane when ORE 99W is widened to 7 lanes • Change to protected left turn phasing on Walnut
31	72nd/Hampton/Hunziker	• Southbound right turn lane OR eastbound right turn lane • Change to protected left turn phasing all directions
32	Durham/Upper Boones Ferry Road	• Reconfigure intersection to make through route between Durham and I-5/Carmen interchange
33	Gaarde/Walnut	• Traffic signal • Eastbound right turn lane
34	68th/Dartmouth	• Traffic signal
35	Carman/I-5 southbound	• Eastbound right turn lane
36	Carman/1-5 northbound	• 2nd westbound through lane • 2nd northbound left turn lane • Eastbound separate through and left turn (2) lanes
	Intersection Safety Enhancements	Evaluate improvements to reduce collisions at high SPIS intersections (refer to 1997-99 intersection list in Chapter 3)
	Pedestrian Crossing Evaluation/Signals	Study and determine appropriate locations for Pedestrian Crossing Signals

Traffic Signal Guidelines

Traffic signal warrant analyses were performed for all unsignalized study intersections operating at LOS E or worse under future base (2015) conditions (Table 8-9). Traffic signal warrants were based on the *Manual on Uniform Traffic Control Device*'s (MUTCD) Warrant 11 (Peak Hour Volume).[19]
To guide future implementation of traffic signals to locations which have the maximum public benefit by serving arterial/collector/neighborhood routes, a framework master plan of traffic signal locations was developed (Figure 8-21). The intent of this plan is to outline potential locations where future traffic

[19] *Manual on Uniform Traffic Control Devices for Streets and Highways*, Federal Highway Administration, 1988 Edition.

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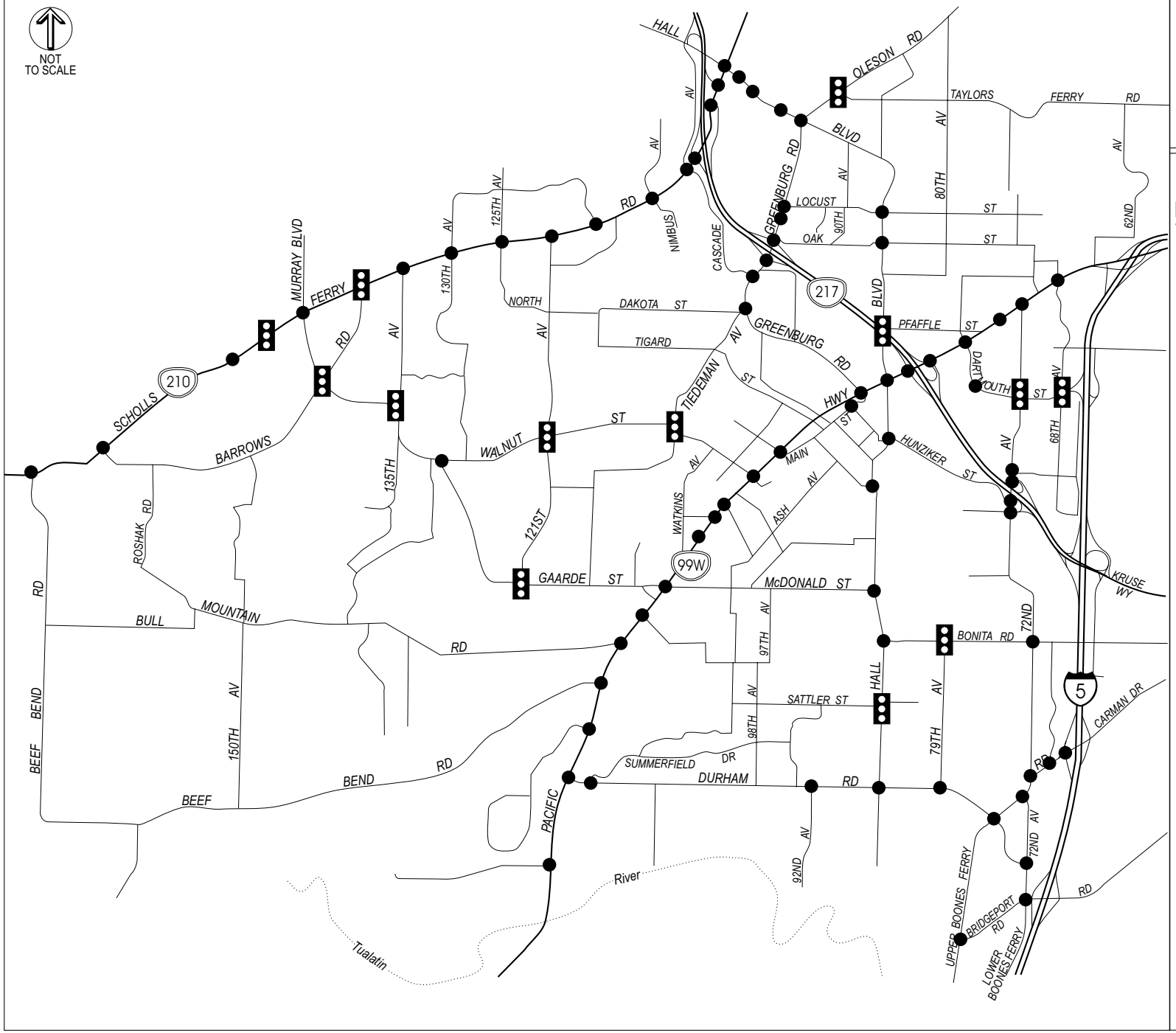

CITY OF TIGARD

Transportation Systems Plan

Legend

- ● - Existing Signalized Intersection
- ▮ - Potential Future Traffic Signal

Note: Signals may be needed at other sites if warranted. This map shows those locations that are most likely to be signalized consistent with TSP objectives.

Figure 8-21
TRAFFIC SIGNAL MASTER PLAN

signals would be placed to avoid conflicts with other development site oriented signal placement. To maintain the best opportunity for efficient traffic signal coordination on arterials, spacing of up to 1,000 feet should be considered. No traffic signal should be installed unless it meets *Manual of Uniform Traffic Control Devices* warrants. Three key traffic signal issues are outlined in this TSP as part of the transportation policy of Tigard:

- Establishing a traffic signal spacing standard of 1,000 feet and a traffic signal master plan to guide future traffic signal placements. When this standard is not met, additional evaluation should be prepared to assure signal progression can be efficiently maintained;
- Traffic signals disrupt traffic flow. Their placement is important for neighborhood access, pedestrian access and traffic control. To not utilize the limited placements of traffic signals to serve private land holdings will limit the potential for use that will generally benefit the public, neighborhoods and pedestrian access. Limiting placement of traffic signals to locations that are public streets would minimize or eliminate the potential for traffic signals solely serving private access.
- ODOT signal design and signal phasing guidelines should be followed for all traffic signal installations.

Table 8-9
Traffic Signal Warrants
MUTCD Peak Hour Volume Warrant

Intersection	Warrant Met?
72nd/Dartmouth	Yes
68th/Dartmouth	Yes
Gaarde/121st	Yes
Gaarde/Walnut	Yes
Walnut/121st	Yes
Walnut/Tiedeman	Yes
Sattler/Hall	Yes
Bonita/79th	Yes

SAFETY

Needs

Accident data was obtained for the City of Tigard from Washington County. Chapter 3 provides detailed data regarding motor vehicle accidents in Tigard. Several strategies are suggested for improving safety in the City of Tigard. These strategies aimed at providing the City with priorities that meet the goals and policies of the City.

- Work with other agencies such as Washington County and ODOT to help prioritize and fund safety programs - coordinated approach
- Develop a citywide safety priority system which identifies high accident locations, ranks the locations and identifies safety mitigation measures
- Address safety issues on an as needed basis

Suggested Improvements

Most of these high accident locations are included in future street improvements listed in Tables 8-6 and 8-7. The only two intersection not being improved are the two on Locust Street (at 72nd and 80th). Accident numbers over three years at these all-way stop sign controlled intersections are very low (3-4 in 3 years). Beyond maintenance, signing and lighting there is little else necessary at these two locations. In the short term, specific action plans should be prepared to address whether beneficial improvements at these locations can be made without affecting future plans.

A future issue with regard to safety involves the decision to go to three lanes from two lanes or five lanes from four lanes. National research has clearly demonstrated the benefits of providing a turning lane when daily traffic volumes exceed 15,000 vehicles per day[20]. While widening the street can commonly be viewed as pedestrian unfriendly, the potential impact of not having a turning lane is that accident rates will increase substantially (11 to 35 percent) on two lane roads compared to three lane roads.

One safety action that can have an immediate impact is to condition all land use development projects that require access on city streets to maintain adequate sight distance. This should address all fixed or temporary objects (plants, poles, buildings, signs, etc.) that potentially obstruct sight distance. Any property owner, business, agency or utility that places or maintains fixed or temporary objects in the sight distance of vehicles, bicycles or pedestrians should be required to demonstrate that adequate sight distance is provided (per American Association of State Highway and Transportation Officials).[21]

Finally, the City should coordinate with Washington County and ODOT to develop real-time accident reporting statistics that allow the city to prioritize current collision issues, not four to seven year old data. Current vendors exist that provide accident report software (Washington County uses Intersection Magic). Tigard, as one of several cities with this need, should work cooperatively with peer jurisdictions to implement software that prioritizes collision locations, produces detailed accident diagrams to allow for assessment and is real time (no more than 3 to 6 months old data with five years of historical data).

[20] Multilane Design Alternatives for Improving Suburban Highways, TRB NCHRP Report No. 282, March 1986.

[21] "A Policy on Geometric Design of Highways and Streets", Green Book American Association of State Highway and Transportation Officials, 1994.

ACCESS MANAGEMENT

Access Management is a broad set of techniques that balance the need to provide efficient, safe and timely travel with the ability to allow access to the individual destination. Both Washington County and ODOT have clear and concise access management policies and the supporting documentation to ensure that the highway system is managed as wisely as possible for the traveling public. Proper implementation of Access Management techniques should guarantee reduced congestion, reduced accident rates, less need for highway widening, conservation of energy, and reduced air pollution.

Access management is control or limiting of access on arterial and collector facilities to preserve their functional capacity. Numerous driveways erode the capacity of arterial and collector roadways. Preservation of capacity is particularly important on higher volume roadways for maintaining traffic flow and mobility. Where as local and neighborhood streets function to provide access, collector and arterial streets serve greater traffic volume. Numerous driveways or street intersections increase the number of conflicts and potential for accidents and decrease mobility and traffic flow. Tigard, as with every city, needs a balance of streets that provide access with streets that serve mobility.

Several access management strategies were identified to improve access and mobility in Tigard:

- Provide left turn lanes where warranted for access onto cross streets
- Work with land use development applications to consolidate driveways where feasible
- Meet Washington County/ODOT access requirements on arterials
- Establish City access standards for new developments on collectors and arterials
- Develop city access requirements that are consistent with Metro Title 6 access guidelines

The following recommendations are made for access management:

- Incorporate a policy statement regarding prohibition of new single family residential access on arterials and collectors. A design exception process should be outlined that requires mitigation of safety and NTM impacts. This addresses a problem in Tigard where property owners consume substantial staff time on issues of residential fronting impacts after they have chosen to build adjacent to an arterial.
- Use Washington County and ODOT standards for access on arterials and collectors under their jurisdiction (see tables showing Washington County and ODOT standards in Appendix).
- Specific access management plans be developed for arterial streets in Tigard to maximize the capacity of the existing facilities and protect their functional integrity. New development and roadway projects should meet the following requirements:

  Arterial: Maximum spacing of roadways and driveways = 1,000 feet
  Minimum spacing of roadways and driveways = 600 feet

  Collector: Maximum Spacing of roadways and driveways = 400 feet
  Minimum Spacing of roadways and driveways = 200 feet

  All Roads: Require an access report stating that the driveway/roadway is safe as designed meeting adequate stacking, sight distance and deceleration requirements as set by ODOT, Washington County and AASHTO.

Access management is not easy to implement and requires long institutional memory of the impacts of short access spacing – increased collisions, reduced capacity, poor sight distance and greater pedestrian exposure to vehicle conflicts. The most common opposition response to access control is that "there are driveways all over the place at closer spacing than mine – just look out there". These statements are commonly made without historical reference. Many of the pre-existing driveways that do not meet access spacing requirements were put in when traffic volumes were substantially lower and no access spacing criteria were mandated. With higher and higher traffic volume in the future, the need for access control on all arterial roadways is critical – the outcome of not managing access properly is additional wider roadways which have much greater impact than access control.

Staff will have to come back at a later to date to propose revisions to the development code to reflect the standards being developed in the TSP and Comprehensive Plan. At that time, additional attention can be given to the specific standards and whether exceptions are appropriate to be written into the code or if variances are the action needed. The ODOT Highway Plan spacing standards will apply to ORE 99W (530 - 740 feet), Hall Boulevard (400 - 475 feet) and streets/driveways within 1,320 feet of ORE 217 or I-5 interchanges. For Washington County roads access spacing standards would be 1,000 feet for major arterials, 600 feet for minor arterials and 150 feet for major collectors. The spacing standards outlined in the TSP would apply for City streets 1,000 feet maximum/600 feet minimum for arterials and 400 feet maximum/200 feet minimum for collectors. The maximum and minimum standards balance safety needs and connectivity needs. Additionally, three other standards are recommended. First, a restriction of direct access of new single family units on arterials and collectors (this would include an exception process that addresses safety and neighborhood traffic management needs). Second, an access report with new land development that requires applicants to verify design of their driveways and streets are safe meeting adequate stacking needs, sight distance and deceleration standards as set by ODOT, Washington County, the City and AASHTO (utilizing future traffic volumes from this TSP as a future base for evaluation). Third, driveways should not be place in the influence area of intersections. The influence area is that area where queues of traffic commonly form on the approach to an intersection (typically between 150 to 300 feet). In a case where a project has less than 150 feet of frontage, the site would need to explore potential shared access, or if that were not practical, place driveways as far from the intersection as the frontage would allow (permitting for 5 feet from the property line).

MAINTENANCE

Preservation, maintenance and operation are essential to protect the City investment in transportation facilities. The majority of current gas tax revenues are used to maintain the transportation system. With an increasing road inventory and the need for greater maintenance of older facilities, protecting and expanding funds for maintenance is critical.

A Pavement Management Program is a systematic method of organizing and analyzing information about pavement conditions to develop the most cost effective maintenance treatments and strategies. As a management tool, it aids the decision-making process by determining the magnitude of the problem, the optimum way to spend funds for the greatest return on the dollar, and the consequences of not spending money wisely. Tigard maintains an annual program of pavement management and monitors

conditions in setting priorities for overlays, slurry seals and joint sealing. With over 130 miles of roadway, maintenance is one of the largest transportation expenditures, requiring almost $1,500,000 per year (to put this budget in perspective, this relates to about $2 per foot of road).

A pavement management program can be a major factor in improving performance in an environment of limited revenues. A pavement management program is not and should not be considered the answer to every maintenance question. It is a tool that enables the public works professional to determine the most cost-effective maintenance program. The concept behind a pavement management system is to identify the optimal rehabilitation time and to pinpoint the type of repair which makes the most sense. With a pavement management program, professional judgment is enhanced, not replaced. A critical concept is that pavements deteriorate 40 percent in quality in the first 75 percent of their life. However, there is a rapid acceleration of this deterioration later, so that in the next 12 percent of life, there is another 40 percent drop in quality. A pavement management system can identify when pavements will begin to deteriorate before rapid deterioration starts to focus preventative maintenance efforts cost effectively. These solutions are generally one-fifth to one-tenth the cost required after a pavement is 80 percent deteriorated. Figure 8-22 illustrates the pavement life cycle.

A visual inspection of Tigard's surface street system was prepared by a consultant for the City of Tigard in 1998/99. This inspection produced a "report card" of the street pavement status for each roadway in Tigard. Figure 8-23 summarizes the pavement condition identified on City streets in the last pavement management inspection. The next pavement inspection will be conducted in 2001. Based upon the last inspection, a determination was made that Tigard has approximately a $3,000,000 back log of needed maintenance that cannot be addressed by annual on-going maintenance programs. Tigard has recently taken on the maintenance and operation of several county roads over the past several years. The on-going maintenance budget has increased as Tigard receives more of the statewide motor vehicle fee allocation for roadway preservation and operation. Table 8-10 summarizes the roadway maintenance funding history for the last five fiscal years.

Table 8-10
City of Tigard Street Maintenance Budget Summary[22]

Requirements	FY 96-97 actual	FY 97-98 actual	FY 98-99 budgeted	FY 99-00 budgeted	FY 00-01 budgeted	Description
Street Maintenance						
Overlays/Slurry Seal	$300,000	$300,000	$300,000	$300,000	$380,000	Contracted out
Minor Safety Imp.	$140,000	$140,000	$140,000	$140,000	$140,000	Small Improvements
NTM	$ 45,000	$ 45,000	$ 60,000	$ 60,000	$ 60,000	Traffic Calming
Striping	$ 7,000	$ 7,000	$ 7,000	$ 7,000	$ 12,000	Restriping roads
Street Program						
Dig Outs/Contracts						Reconstruction, Signs,
LaborOutlay	$523,000	$620,000	$814,000	$1,050,000	$774,000	Guard rail, Sweeping
Capital/Equipment						
Administration	$30,000	$31,000	$41,000	$58,000	$55,000	
Total	**$1,045,000**	**$1,143,000**	**$1,362,000**	**$1,615,000**	**$1,421,000**	

Note: Tigard started maintaining an increase share of County streets from 1997 to present.

[22] Based on information received from Gus Duneas, City of Tigard, February 2000.

CITY OF TIGARD
Transportation
System Plan

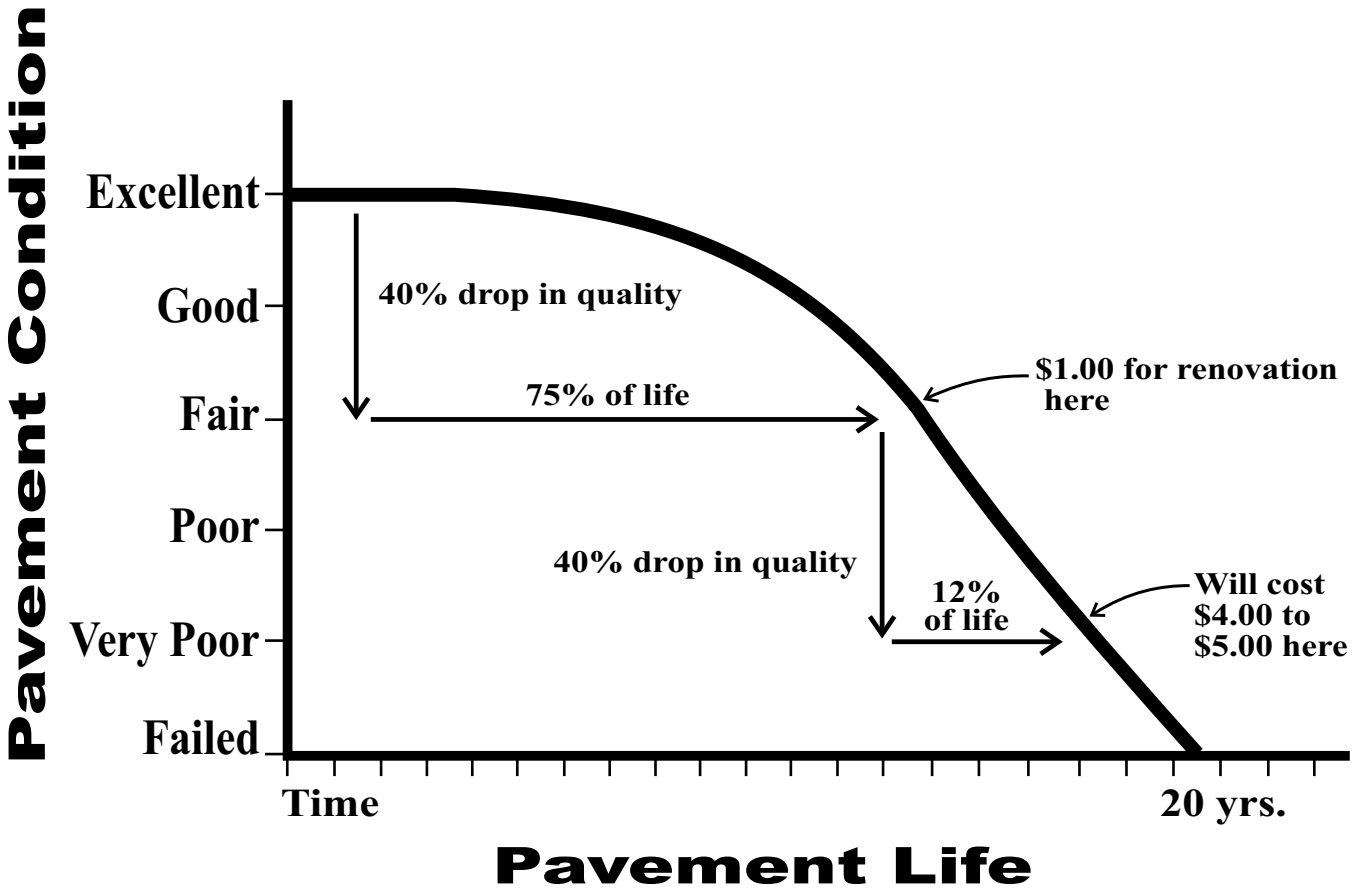

Figure 8-22
PAVEMENT LIFE CYCLE

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CITY OF TIGARD

Transportation Systems Plan

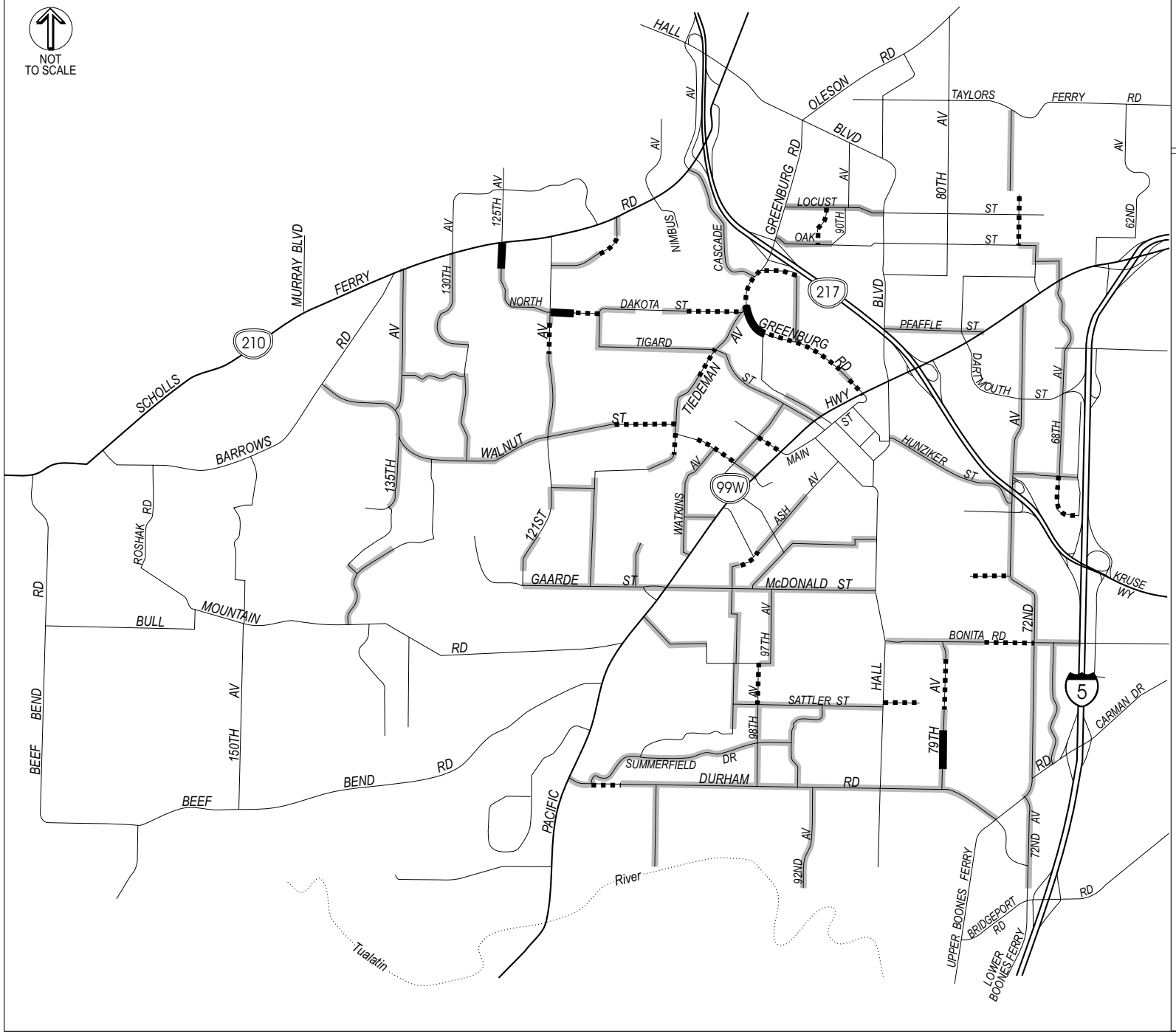

Figure 8-23
PAVEMENT CONDITION ON CITY STREETS

NEIGHBORHOOD TRAFFIC MANAGEMENT

Neighborhood Traffic Management (NTM) is a term that has been used to describe traffic control devices typically used in residential neighborhoods to slow traffic or possibly reduce the volume of traffic. NTM is descriptively called traffic calming due to its ability to improve neighborhood livability. Tigard has done extensive work in the way of testing and implementing NTM measures such as speed humps, chokers, pavement texturing, circles, chicanes and other elements (Figure 8-24). The City initiated a formalized NTM program in 1995 and expends about $60,000 per year in traffic calming city wide. The following are examples of neighborhood traffic management strategies:

- speed wagon (reader board that displays vehicle speed)
- speed humps
- traffic circles
- medians
- landscaping
- curb extensions
- chokers (narrows roadway at spots in street)
- narrow streets
- closing streets
- photo radar
- on-street parking
- selective enforcement
- neighborhood watch

Typically, NTM can receive a favorable reception by residents adjacent to streets where vehicles travel at speeds above 30 MPH. However, NTM can also be a very contentious issue within and between neighborhoods, being viewed as moving the problem rather than solving it, impacting emergency travel or raising liability issues. A number of streets in Tigard have been identified in the draft functional classification as neighborhood routes. These streets are typically longer than the average local street and would be appropriate locations for discussion of NTM applications. A wide range of traffic control devices is being tested throughout the region, including such devices as chokers, medians, traffic circles and speed humps. NTM traffic control devices should be tested within the confines of Tigard before guidelines are developed for implementation criteria and applicability. Also, NTM may be considered in an area wide manner to avoid shifting impacts between areas and should only be applied where a majority of neighborhood residents agree that it should be done. Strategies for NTM seek to reduce traffic speeds on neighborhood routes, thereby improving livability. Research of traffic calming measures demonstrates their effectiveness in reducing vehicle speeds. Table 8-11 summarizes nationwide research of over 120 agencies in North America.

The City could consider adopting a neighborhood traffic management program. This program would help prioritize implementation and address issues on a systematic basis rather than a reactive basis. Criteria should be established for the appropriate application of NTM in the City. This would address warrants, standards for design, funding, the required public process, use on collectors/arterials (fewer acceptable measures – medians) and how to integrate NTM into all new development design.

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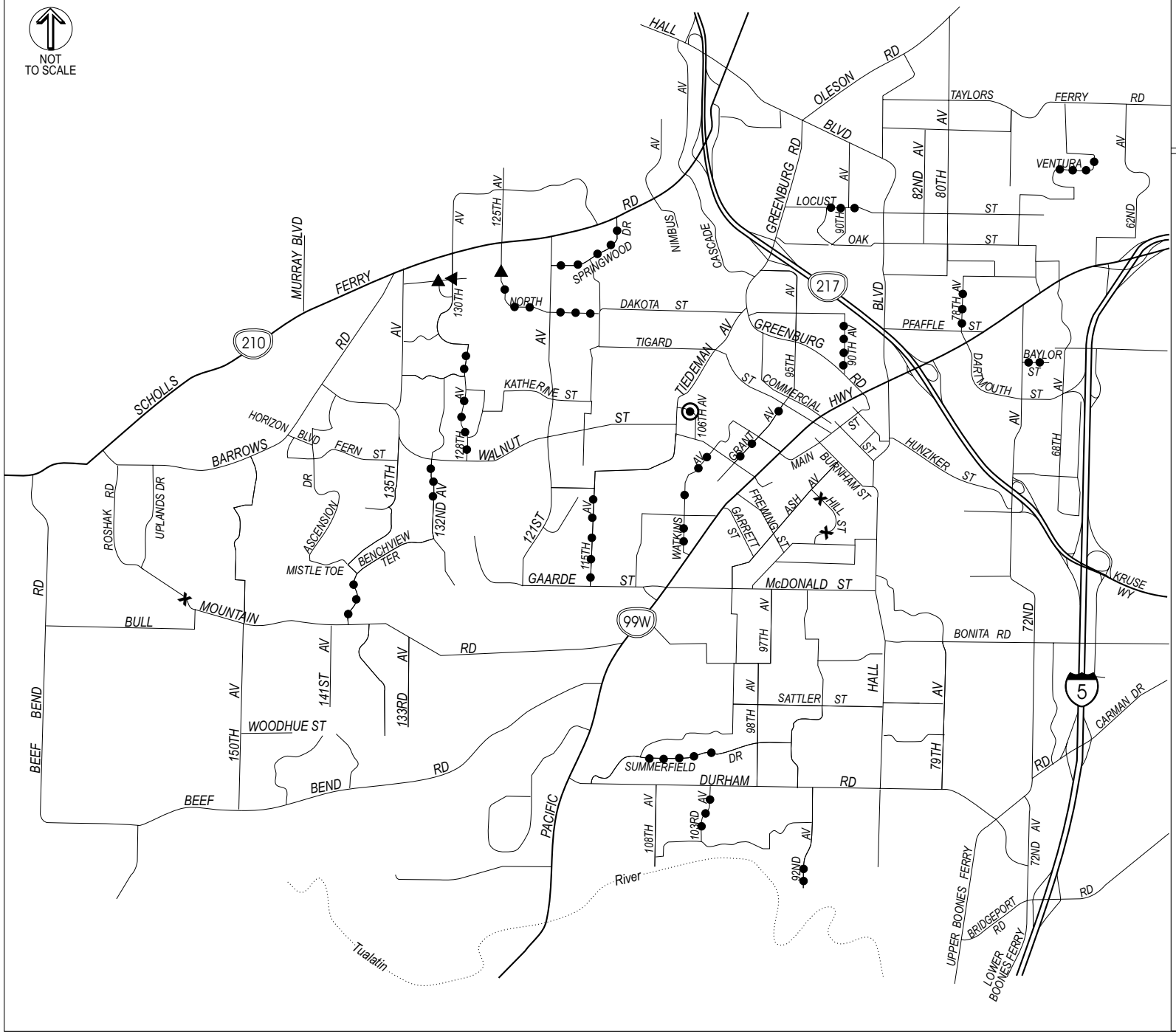


CITY OF TIGARD

Transportation Systems Plan

Legend

- ● - Speed Hump
- ◉ - Portable Speed Hump
- ▲ - Diverter (Shows Direction)
- x - Islands in Intersection

Figure 8-24
TRAFFIC CALMING MEASURES INVENTORY

Table 8-11
NTM Performance

Measures	No. of Studies	Speed Reduction (MPH) Low	High	Average	Volume Change (ADT) Low	High	Ave.	Public Satisfaction
Speed Humps	262	1	11.3	7.3	0	2922	328	79%
Speed Trailer	63	1.8	5.5	4.2	0	0	0	90%
Diverters	39	-	-	.4	85	3000	1102	72%
Circles	26	2.2	15	5.7	50	2000	280	72%
Enforcement	16	0	2	2	0	0	0	71%
Traffic Watch	85	.5	8.5	3.3	0	0	0	98%
Chokers	32	2.2	4.6	3.3	45	4100	597	79%
Narrow Streets	4	5	7	4.5	0	0	0	83%

SOURCE: *Survey of Neighborhood Traffic Management Performance and Results, ITE District 6 Annual Meeting, by R S. McCourt, July 1997.*

PARKING

Parking has not typically been a significant transportation issue in the past for Tigard. New land uses were required to provide the code designated number of parking spaces to assure there would be no impact to surrounding land uses (overflow parking). These parking ratios were developed based upon past parking demand characteristics of each land use type. Most recently, parking has become an element of transportation planning policy through two actions. The adoption of the Transportation Planning Rule in 1991, which was updated in November 1998 (sections 660-12-020(2g) and 660-12-045(5c)) and the Metro Functional Plan of November 1996, Title 2. The City of Tigard has adopted these changes in section 18.765 of its Development Code (refer to Table 18.765.2 Minimum and Maximum Required Off-street Vehicle and Bicycle Parking Requirements). By adopting the minimum and maximum parking ratios outlined in Title 2, the City has addressed the TPR required reduction in parking spaces per capita over time.

Several strategies were identified to address the desire to reduce parking needs in Tigard:

- Shared parking
- Parking pricing
- Parking needs should be reviewed by individual developments at the site plan review stage. Parking provisions should be compared to demand, as identified by ITE or DEQ.[23]
- Maximum Parking Ratios

One of the concerns with parking reduction policies is the impact to adjacent land uses should the vehicle needs of a site exceed the provision of parking.

[23] *Parking Demand*, 2nd Edition, Institute of Transportation Engineers, 1987; and *Peak Parking Space Demand Study*, Oregon Department of Environmental Quality, by JHK & Associates, June 1995.

TRANSPORTATION SYSTEM MANAGEMENT/ INTELLIGENT TRANSPORTATION SYSTEMS

Transportation System Management (TSM) focuses on low cost strategies to enhance operational performance of the transportation system. Measures that can optimize performance of the transportation system include signal improvements, intersection channelization, access management (noted in prior section), HOV lanes, ramp metering, rapid incident response, and programs that smooth transit operation (refer to Table 8-7 for samples of intersection-level TSM improvements). The most significant measure that can provide tangible benefits to the traveling public is traffic signal coordination and systems. Traffic signal system improvements can reduce the number of stops by 35 percent, delay by 20 to 30 percent, fuel consumption by 12.5 percent and emissions by 10 percent[24]. This can be done without the major cost of roadway widening. Ramp metering has been proven to improve freeway performance, reducing travel time, reducing accidents, increasing vehicle speed and reducing fuel consumption. ODOT plans to meter all the on-ramps to I-5 and ORE 217 within Tigard (presently the ORE 217 ramps are metered). As ramp metering is installed in Tigard, the City should work with ODOT to develop ramp meter bypass lanes for high occupancy vehicles and transit.

Several of the strategies were elements of an Intelligent Transportation System (ITS) plan being implemented regionally by ODOT and participating agencies. ITS focuses on a coordinated, systematic approach toward managing the region's transportation multi-modal infrastructure. ITS is the application of new technologies with proven management techniques to reduce congestion, increase safety, reduce fuel consumption and improve air quality. One element of ITS is Advanced Traffic Management Systems (ATMS). ATMS collects, processes and disseminates real-time data on congestion alerting travelers and operating agencies, allowing them to make better transportation decisions. Examples of future ITS applications include routine measures such as "smart" ramp meters, automated vehicle performance (tested recently in San Diego), improved traffic signal systems, improved transit priority options and better trip information prior to making a vehicle trip (condition of roads - weather or congestion, alternative mode options - a current "real time" schedule status, availability/pricing of retail goods). Some of this information will be produced by Tigard, but most will be developed by ODOT or other ITS partners (private and public). The information will be available to drivers in vehicles, people at home, at work, at events or shopping. The Portland region is just starting to implement ITS and the City of Portland, Tri-Met and ODOT have already developed their own ITS strategic plans.

TRUCKS

Efficient truck movement plays a vital role in maintaining and developing Tigard's economic base. Well planned truck routes can provide for the economical movement of raw materials, finished products and services. Trucks moving from industrial areas to regional highways or traveling through Tigard are different than trucks making local deliveries. The transportation system should be planned to accommodate this goods movement need. The establishment of through truck routes provides for this efficient movement while at the same time maintaining neighborhood livability, public safety and minimizing maintenance costs of the roadway system. A map of proposed through truck routes in Tigard was developed (Figure 8-25). This map is built from the approved Through Truck Route Map

[24] *Portland Regionwide Advanced Traffic Management System Plan,* ODOT, by DKS Associates, October 1993.

in the Washington County Transportation Plan (1988), the recent Metro Regional Freight System (1999) and this plan.

The plan is aimed at addressing the through movement of trucks, not local deliveries. The objective of this route designation is to allow these routes to focus on design criteria that is "truck friendly", i.e., 12 foot travel lanes, longer access spacing, 35 foot (or larger) curb returns and pavement design that accommodates a larger share of trucks. Because these routes are through routes and relate to regional movement, they should relate to the regional freight system. The Draft Regional Transportation Plan[25] includes the following routes in the regional freight system in Tigard, which are consistent with the city map:

- I-5, ORE 217 and ORE 99W — Main Roadway Route
- 72nd Avenue south of ORE 217 — Road Connector
- Hunziker Street east of Hall Boulevard — Road Connector
- Scholls Ferry Road from east of Nimbus to ORE 217 — Road Connector

Key differences from the City TSP truck plan to the to the previously adopted Washington County Plan and Metro RTP include the following:

- Hall Boulevard south of Hunziker Street is removed from the plan along with Durham Road east of Hall Boulevard as shown in the Washington County Plan. In its place Hunziker Street and 72nd Avenue south of ORE 217 are added (as they are in the Regional Freight System).

- Scholls Ferry Road west of Nimbus and east of ORE 217 to Hall Boulevard are retained from the Washington County Plan (although not part of the Regional Freight System) along with Hall Boulevard from ORE 217 to Hunziker.

There are other streets in Tigard that due to their adjacent land uses will need to be "truck friendly". Local industrial streets such as Tech Center Drive and Wall Street would represent samples of streets which where the local industrial street cross-section (Figure 8-7) would apply. In the future, industrial land development will need similar connections to the through truck routes.

Criteria

Tigard's TSP Advisory Committee created a set of goals and policies to guide transportation system development in Tigard (see Chapter 2). Several of these policies pertain specifically to trucks:

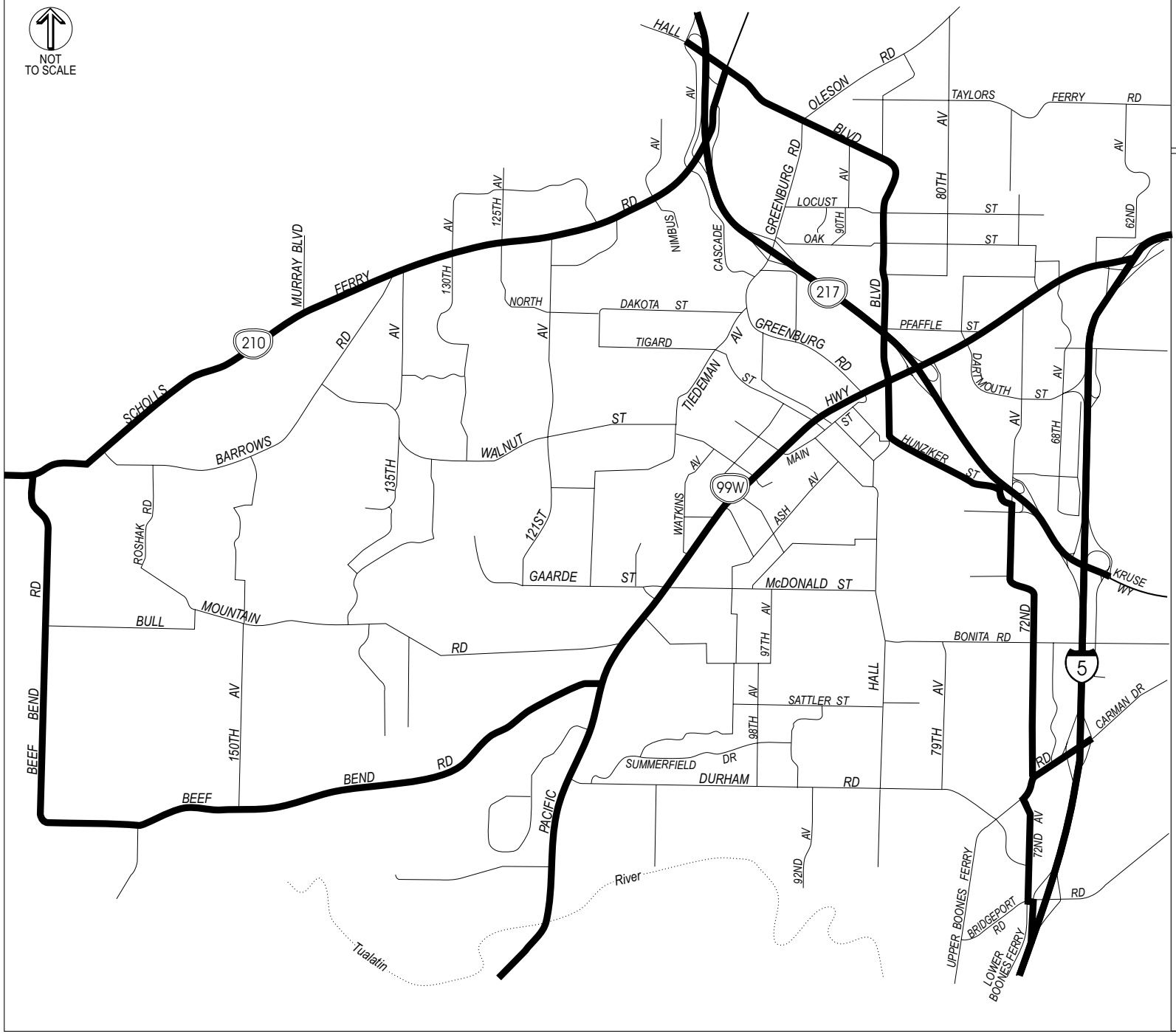
Goal 2: Multi-Modal

Policy 1 Develop and implement public street standards that recognize the multi-purpose nature of the street right-of-way for utility, pedestrian, bicycle, transit, truck and auto use.

[25] *Draft Regional Transportation Plan*, Metro, December 1999.

DKS Associates

NOT TO SCALE



CITY OF TIGARD

Transportation Systems Plan

Legend

- Through Truck Routes

Figure 8-25
THROUGH TRUCK ROUTES

Goal 6: Goods Movement

Policy 1 Design arterial routes, highway access and adjacent land uses in ways that facilitate the efficient movement of goods and services.

Policy 2 Require safe routing of hazardous materials consistent with federal and state guidelines.

These goals and policies are the criteria that all truck related improvements in Tigard should be measured against to determine if they conform to the intended vision of the City.